

PROJECT MANUAL

PROJECT NO: 1711

DATE: December 7, 2022

**A NEW FACILITY FOR
FIRST COMMUNITY BANK
HWY. 62/412 AND BIG CREEK ROAD
Jonesboro, Arkansas**

ROARK • PERKINS • PERRY • YELVINGTON



713 WEST SECOND STREET

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PROJECT MANUAL

FOR

**A NEW FACILITY FOR
FIRST COMMUNITY BANK
HWY. 62/412 AND BIG CREEK ROAD
Jonesboro, AR**

December 7, 2022

RPPY PROJECT #1711

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END OF DOCUMENT

INVITATION TO BID

Project: A New Facility for
First Community Bank
Hwy. 62/412 and Big Creek Road
Jonesboro, AR

Owner: First Community Bank
Mr. Dale Cole

Architect: Roark Perkins Perry & Yelvington

Date: December 7, 2022

Your firm is invited to submit a Bid to the Owner for construction of a new regional office for First Community Bank located at the above address. The Owner will receive Bids until 2:00 PM local time on Thursday, the 26th day of January, 2023.

Description: Work includes site work, fire protection, general construction, HVAC, plumbing and electrical work.

Identify Contract Time in the Bid Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.

Copies of the Contract Documents are available for review at the office of the Architect and at Southern Reprographics. Invited general contractors may obtain one complete set of Contract Documents and one hard copy emailed to them by contacting the Architect. Additional copies of Contract Documents may be obtained at the cost of reproduction from Southern Reprographics. Bids submitted by General Contractors who obtain documents by any other means, will be disqualified.

Subcontractors and suppliers may visit www.sribids.com for viewing and or downloading of electronic documents at no cost. Access to this site requires that you enter the following information: RPPY1711.

Bidders will be required to provide Bid security in the form of a Bid Bond in the amount of 5 percent of the Bid Sum. Refer to other bidding requirements described in Document 00 21 13, and Document 00 31 00. Submit your Bid on the Bid Form provided.

Your Bid will be required to be submitted under a condition of irrevocability for a period of 60 days after submission. The Owner reserves the right to accept or reject any or all Bids.

Mr. Dale Cole
First Community Bank

Enclosures

END OF DOCUMENT

INSTRUCTIONS TO BIDDERS

1.1 SUMMARY

- A. Document Includes:
 - 1. Bid submission.
 - 2. Work identified in contract documents.
 - 3. Contract Time.
 - 4. Definitions.
 - 5. Contract Documents identification.
 - 6. Availability of documents.
 - 7. Examination of documents.
 - 8. Inquiries and addenda.
 - 9. Product substitutions.
 - 10. Site examination.
 - 11. Subcontractors.
 - 12. Submission procedure.
 - 13. Bid ineligibility.
 - 14. Security deposit.
 - 15. Performance assurance.
 - 16. Additional bid information.
 - 17. Bid opening.
 - 18. Duration of offer.
 - 19. Acceptance of offer.
- B. Related Documents:
 - 1. Document 00 11 16 - Invitation to Bid.
 - 2. Document 00 31 00 - Available Project Information.
 - 3. Document 00 41 13 - Bid Form.
 - 4. Document 00 41 43 - Bid Form Appendices.
 - 5. Document 00 73 13 - Supplementary Conditions

1.2 BID SUBMISSION

- A. Bids signed, executed, and dated will be received by the Owner in the Board Room at the First Community Bank, located at 630 Southwest Drive in Jonesboro, AR until 2:00 PM local time on Thursday, the 26th day of January, 2023.
- B. Bids submitted after the above time will be returned to Bidder unopened.
- C. Amendments to submitted Bids will be permitted when received in writing prior to bid closing and when endorsed by the same party or parties who signed and sealed the Bid.
- D. Bidders may withdraw their Bid by written request at any time before bid closing.

1.3 WORK IDENTIFIED IN CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises site development, and general construction, including civil, fire protection, structural, mechanical, and electrical Work.

- B. Location: Hwy. 62/412 and Big Creek Road, Jonesboro, AR.

1.4 CONTRACT TIME

- A. Identify Contract Time in the Bid Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.
- B. The Owner requires the work of this contract be completed as quickly as possible. Consideration will be given to time of completion when reviewing submitted Bids.

1.5 DEFINITIONS

- A. Bidding Documents: Contract Documents supplemented with Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, Bid Form Appendices, and bid securities, identified.
- B. Contract Documents: Defined in AIA Document A201-2017 Article 1, including issued Addenda.
- C. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.
- D. Bid Sum: Monetary sum identified by the Bidder in the Bid Form.

1.6 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as Project number #1711 as prepared by RPPY Architects located at 713 W. 2nd Street in Little Rock, AR and as identified in the Project Manual.

1.7 AVAILABILITY OF DOCUMENTS

- A. Bidding Documents may be obtained as stated in Invitation to Bid.
- B. Partial sets of Bidding Documents will not be issued to general contract Bidders.
- C. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.8 EXAMINATION OF DOCUMENTS

- A. Bidding Documents may be viewed at the office of the Architect/Engineer and at Southern Reprographics.
- B. Upon receipt of Bidding Documents verify documents are complete. Notify Architect/Engineer if documents are incomplete.
- C. Immediately notify Architect/Engineer upon finding discrepancies or omissions in Bidding Documents.

1.9 INQUIRIES AND ADDENDA

- A. Direct questions in writing to Stephan Seng, at the office of the Architect/Engineer; ss@rppyarchitects.com.
- B. Verbal answers are not binding on any party.
- C. Submit questions not less than 3 days before date set for receipt of Bids. Replies will be made by Addenda.
- D. Addenda may be issued during bidding period. Addenda will be sent to known Bidders. Addenda become part of the Contract Documents. Include resultant costs in the Bid Sum.

1.10 PRODUCT SUBSTITUTIONS

- A. Requests for product substitutions are not permitted during bidding. Refer to Section 01 60 00 - Product Requirements for substitution procedures.
- B. In submission of substitutions to Products specified, Bidders shall include in their Bid, changes required in the Work and changes to Contract Time and Contract Sum to accommodate such approved substitutions. Later claims by the Bidder for an addition to the Contract Time or Contract Sum because of changes in Work necessitated by use of substitutions will not be considered.

1.11 SITE EXAMINATION

- A. Examine Project site before submitting a Bid.

1.12 SUBCONTRACTORS

- A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.
- B. Refer to AIA Document A201-2017, Article 5 of General Conditions.

1.13 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for delivery of Bids in manner and time prescribed.
- B. Submit one copy of executed offer on Bid Forms provided, signed with required security deposit in a closed opaque envelope, clearly identified with Bidder's name, Project name, and Owner's name on the outside.
- C. Improperly completed information, irregularities in bid bond, may be cause not to open the Bid Form envelope and declare the Bid invalid or informal.
- D. An abstract summary of submitted Bids will be made available to all Bidders following bid opening.

1.14 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may be declared unacceptable at Owner's discretion.
- B. Bid Forms, Appendices, and enclosures which are improperly prepared may be declared unacceptable at Owner's discretion.
- C. Failure to provide security deposit, bonds or insurance requirements may invalidate the Bid at the discretion of the Owner.
- D. Bids are by invitation, only, from selected Bidders. Unsolicited Bids will be returned.

1.15 SECURITY DEPOSIT

- A. Bids shall be accompanied by security deposit as follows:
 - 1. Bid Bond of a sum no less than 5 percent of the Bid Sum on standard surety company form.
- B. Endorse Bid Bond in name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.
- C. Security deposit of accepted Bidder will be returned after delivery to the Architect of the required Performance and Payment Bonds by the accepted Bidder.
- D. Include the cost of security deposit in the Bid Sum.
- E. After a Bid has been accepted, security deposits will be returned to the respective Bidders.
- F. If no contract is awarded, security deposits will be returned.

1.16 PERFORMANCE ASSURANCE

- A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00 73 13.
- B. Include the cost of performance assurance bonds in the Bid Sum and identify the cost when requested by the Owner.

1.17 ADDITIONAL BID INFORMATION

- A. Complete and submit Document 00 43 00 with Bid.

1.18 BID OPENING

- A. Bids will be opened publicly immediately after time for receipt of Bids. Bidders may be present.

1.19 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of 60 days after bid closing date.

1.20 ACCEPTANCE OF OFFER

- A. The Owner reserves the right to accept or reject any or all offers.
- B. After acceptance by the Owner and receipt of required insurance, the Architect/Engineer, on behalf of the Owner, will issue to the accepted Bidder, a written Notice to Proceed.
- C. Notwithstanding delay in the preparation and execution of the Agreement, accepted Bidder shall be prepared, upon written Notice to Proceed, to commence work within ten days following receipt of official written order of the Owner to proceed, or on date stipulated in such order.

END OF DOCUMENT

AVAILABLE PROJECT INFORMATION

1.1 SUMMARY

- A. Document Includes: Subsurface investigation report.
- B. Related Documents:
 - 1. Document 00 21 13 - Instructions to Bidders: Site examination.

1.2 SUBSURFACE INVESTIGATION REPORT

- A. A copy of a geotechnical report is included with this document, titled Geotechnical Investigation for Proposed First Community Bank – Greensboro Village, Jonesboro, AR, dated March 24, 2022, and prepared by Anderson Engineering Consultants, Inc.
- B. This report identifies properties of below grade conditions and offers recommendations for design of foundations, prepared primarily for use of Architect/Engineer.
- C. Recommendations described are not requirements of this Contract, unless specifically referenced in Contract Documents.
- D. This report, by its nature, cannot reveal all conditions existing on the site. Should subsurface conditions be found to vary substantially from this report, changes in design and construction of foundations will be made, with resulting credits or expenditures to Contract Price/Sum accruing to Owner.

END OF DOCUMENT



ANDERSON ENGINEERING CONSULTANTS, INC.

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3217 NEIL CIRCLE - JONESBORO, AR 72401
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AECI.JONESBORO@GMAIL.COM

**GEOTECHNICAL INVESTIGATION
FOR
PROPOSED FIRST COMMUNITY BANK - GREENSBORO VILLAGE
JONESBORO, ARKANSAS**

* * * * *

**FIRST COMMUNITY BANK
OWNERS
1325 HARRISON STREET
BATESVILLE, ARKANSAS 72501**

* * * * *

MARCH 24, 2022

JOB NO. 17044





ANDERSON ENGINEERING CONSULTANTS, INC.

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March 24, 2022

Job No. 17044

Mr. Dale E. Cole, Chairman & CEO
First Community Bank
1325 Harrison Street
Batesville, Arkansas 72501

Email: dcole@firstcommunity.net

Re: Geotechnical Investigation
Proposed First Community Bank - Greensboro Village
Jonesboro, Arkansas

Dear Mr. Cole:

It is our pleasure to submit this report on the soil and foundation investigation for the proposed First Community Bank - Greensboro Village in Jonesboro, Arkansas. The investigation consisted of field test borings, soils laboratory analyses, pavement analyses, and foundation design analyses.

Soft soils were encountered in most areas at the surface and could require varying amounts of undercut. We recommend that our geotechnical services be continued in the construction phase of the project for this is the most feasible means of assuring the owners, designers, and builders that the geotechnical design intent is being achieved. In the event that adverse geotechnical conditions are encountered during construction, they can be identified and evaluated, and prompt remedial measures can be taken during construction.

We wish to express our appreciation for the opportunity of serving you and other members of the design team. We are available for further consultation during the design and construction at any time, should you have a need for further assistance.

Very truly yours,

ANDERSON ENGINEERING CONSULTANTS, INC.



Stuart M. Scheiderer, R.E.P., P.E.
Senior Geotechnical Engineer

Scott W. Anderson, R.E.P., P.E.
Principal Engineer



SMS/SWA/llb
17044.GEO

GEOTECHNICAL INVESTIGATION
FOR
PROPOSED FIRST COMMUNITY BANK - GREENSBORO VILLAGE
JONESBORO, ARKANSAS

* * * * *

FIRST COMMUNITY BANK
OWNERS
1325 HARRISON STREET
BATESVILLE, ARKANSAS 72501

* * * * *

BY
ANDERSON ENGINEERING CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
10205 ROCKWOOD ROAD
LITTLE ROCK, ARKANSAS 72204

MARCH 24, 2022

JOB NO. 17044

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PLATE

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PURPOSE

The primary purposes of this geotechnical investigation were:

- a. To determine the physical and engineering properties of the soils within the area of the proposed construction with respect to their suitability for the support of the proposed structure.
- b. To make recommendations for the earthwork, pavements, and the type of foundation suited for the prevailing soil conditions within the proposed construction area.
- c. To evaluate and recommend the design procedures for the various soil, pavement, and foundation items in accordance with current engineering practices.

SCOPE

The scope of this geotechnical investigation includes the following:

- a. The geologic features of the job site area consist essentially of terrace deposits of sands, silts, and clays. The site stratigraphy was defined by seven auger/wash borings terminated at depths of 6.5 to 16.5 feet as authorized by the client.
- b. Field testing consisted of Standard Penetration test samples (ASTM D 1586) taken in all of the borings. Soils were visually classified in the field by a soils engineering technician.
- c. The soils analyses were based on N-values obtained from the Standard Penetration tests, moisture content, Atterberg limits, mechanical grain size analysis, shrink/swell tests, visual observations, and other routine inspection and classification methods. The soils were classified basically in accordance with the Unified Soil Classification System (ASTM D 2487); however, visual classifications may be given on the logs.
- d. The foundation bearing capacity and settlement analyses were based on our current foundation design procedures, using the Standard Penetration N-values obtained during drilling and the results of the laboratory testing program.
- e. Pavement sections provided in this report were determined from correlation with field and laboratory data developed in this investigation.

AUTHORITY

This geotechnical investigation was authorized by signed acceptance of Proposal No. 22041 on February 8, 2022, by Mr. Dale E. Cole, of First Community Bank, the owner's representative for the proposed project.

PROJECT DESCRIPTION

The site of the proposed project is located at the northeast corner of the intersection of East Johnson Avenue and Chancery Lane in Jonesboro, Arkansas, as illustrated on the Vicinity Map, Plate 1. The footprint of the building is approximately 4000 square feet and will be located in the middle of the

site. Access will be from the north side of the site. Pavements/drives surround the building with a drive-through planned on the north side of the building. Though existing and proposed grades were not provided, varying amounts of fill are anticipated. Loads for the building are anticipated to be light to moderate.

GEOTECHNICAL INVESTIGATION

On March 6, 2022, a geotechnical drilling crew performed the drilling and sampling of seven borings at the proposed project site. The test borings were placed at strategic locations across the site in the building and paving areas, as shown on the Plan of Borings, Plate 2. As a result of the drilling program, boring logs showing stratigraphic and field testing information are provided on Plates 3 through 9. The Field Classification System for Soil Exploration and Key to the Soil Classifications and Symbols are given on Plates 10 and 11. These systems are provided to aid the reader in interpreting the various symbols used on the logs of borings. The Unified Soil Classification System is given on Plate 12. This system is used to determine the soil classification and to develop the terminology used on the logs of borings.

GEOLOGY/STRATIGRAPHY

The Jonesboro, Arkansas, area lies within the Mississippi Embayment Physiographic region of eastern Arkansas. This area consists of a complex layering of alluvial and terrace deposits of silts, clays, and sands with lenses of clay and gravel from the Quaternary Period. The soils range, in general, from clays to sands. The site soils were found to be consistent with the area geology and consisted of clay (CL) overlying silty sand (SM) that extended to the terminal depths investigated. Previous experience in the area indicates the basal units in the area to be dense sands and gravels. The soils encountered are considered be consistent with the general geology.

GROUNDWATER CONDITIONS

The groundwater table was not encountered during the field investigation. Previous experience in the area indicates that groundwater will typically be encountered at a depths greater than 20.0 feet with some perched water above the less permeable overburden soils. The perched water level typically is considered to be seasonal in nature and will rise and fall with fluctuations in rainfall. Thus, groundwater may be encountered during construction, especially in wet or winter months, and should be considered in design and construction of deep foundations, utilities, equipment pits or elevator shafts. Temporary dewatering of these types of excavations by sump/pump may be required.

Perched water is typically encountered in near soils above the less permeable soils and in the vicinity of existing structures, pavements, or utilities. This latent water condition is typically due to storage of recent rainfall or by a barrier to capillary evaporation. Perched water, when encountered, could

be moderate to significant. Areas likely to contain perched water include old fill areas, paved areas, old drainage swales, existing utility trenches, and within the drip line of trees.

Where perched water is encountered the contractor should expect to excavate gravity drainage ditches to divert it away from the construction area. Additionally, soft, wet and pumpable soils can be expected. In structural areas, these soils should be removed and replaced with a select fill soil compacted in accordance with criteria provided in the **EARTHWORK** section of this report. Since the quantity of undercut is unknown, it would be prudent to establish a unit rate for this item of work to minimize construction delays.

SITE DRAINAGE

The designer should also consider the topography of the site and surrounding areas during planning, design, and construction. The final grading should ensure positive drainage away from building. It is strongly recommended that roof drains, condensate lines, and other potential water sources divert water away from the building, preferably to the storm sewer system, to prevent accumulation around the perimeter of the proposed structure. The overburden soils have the ability of absorbing significant amounts of moisture, which could be detrimental as strength loss typically result.

Consideration should be given to control of surface water runoff during construction. The proposed construction areas are relatively flat. Existing drainage features should be maintained as functional as possible during construction. The proposed construction areas should be maintained in a well drained condition to prevent water from ponding within the structural areas.

SEISMICITY

The seismic analysis requires the selection of appropriate site coefficients and other seismic values that can be established from the subsurface conditions, guidelines set forth by local, state, and federal codes, and historical seismic information. The structure should be designed using guidelines as set forth in the 2015 International Building Code as required by **Arkansas Act 1100-1991** (and subsequent amendments) as determined appropriate. The site soils consist primarily of clay (CL) overlying silty sand (SM) that extended to the terminal depths investigated. The following seismic values are considered applicable to this project site based upon the site conditions and the 2015 International Building Code (IBC) seismic values for Arkansas:

IBC (2015)

Site Class	D
Value of Site Coefficient (F_a)	1.000
Value of Site Coefficient (F_v)	1.500
Spectral Response Acceleration at Short Periods (S_s)	1.507 g
Spectral Response Acceleration at a Period of 1.0 Second (S_1) ..	0.526 g
Peak Ground Acceleration	0.890 g

LABORATORY TESTING

The samples obtained from the borings were returned to the laboratory for further observation and testing. The moisture content of samples tested exceeded 22.4% in most cases, which is considered excessive and correlated with low strength (N-values). Atterberg limit tests performed indicate most soils are slightly plastic with liquid limits ranging from 34 to 41 and plasticity index values between 15 and 23. These values increased in an isolated sample at the surface to 46 and 27, respectively. Soils with higher PI values should be removed. The clay soils were found to consist of 92.9% fines (passing the No. 200 sieve), resulting in a classification of silty clay (CL). The amount of fines significantly decreased in the deeper sands, resulting in a classification of silty sand (SM). A representative sample of shallow clay was remolded at its natural moisture content and inundated to assess the swell potential of these soils. A negligible swell pressure resulted and linear shrinkage value of 5.6% was determined. Provided the criteria in the **EARTHWORK** section is met or exceeded, swell and potential vertical rise (PVR) values should be maintained at tolerable limits (<0.50-inch). Individual test results are provided in Appendix B.

EARTHWORK

The following sections are intended to provide the designer and contractor with guidelines for construction of the project. They are not intended to be used as a specification for construction procedures or methods. It is strongly recommended that any desired modification be reviewed by the soils engineer prior to implementation into the project specifications. Site conditions different from those indicated herein may result in alteration of these recommendations, but should be verified by the soils engineer, or his representative.

Pre-Construction Considerations:

The condition of the subgrade materials should be considered a significant factor in the early stages of project planning and construction. The conditions reflected herein are based on the data obtained from the borings and the soil condition at the time of drilling. Data obtained from the borings can be effected by seasonal fluctuations in rainfall and temperatures. Some improvement in the condition of the materials should be expected in the summer months. Construction planning and sequencing will likely be a crucial factor on the amount of undercut required for soft soil conditions. Scarification, aeration, 'wind-rows' and other methods to stabilize soils in-place should be explored prior to making the determination of undercut.

Though efforts have been made to outline climatic factors and their potential impact on construction, some factors also will have a significant impact. Time constraints (proposed schedule) may restrict the contractor's ability to process wet soils. The means and methods of the contractor are not necessarily considered in the recommendations contained herein. The recommendations for site

preparation are intended for a normal construction sequence. Prepared subgrade or compacted fill should not be subjected to prolonged periods of weather or construction traffic. Areas intended to be used as staging by the contractor will likely require additional processing and compaction due to distress caused by construction traffic.

It is highly recommended that the geotechnical engineer be included in pre-construction meetings. It would be prudent to perform a limited investigation (probing or test pits) to verify the soil conditions immediately prior to site work and determine if the recommendations contained herein warrant modification.

Site Preparation:

The site does not appear to have been developed in the past. However, visual observation indicate some earthwork or construction activities could have occurred, likely due to the recent construction of Chancery Lane. Scattered debris was observed across the site. Though not encountered in the borings, there is considered to be an increased potential of encountering buried debris or organic laden soils. These materials should be removed if encountered.

In any case, vegetation and topsoil (± 6.0 inches) should be removed within the proposed construction areas. Any required cuts should be performed allowing the exposed subgrade to be proof rolled. Data obtained from the borings indicate soft soils are present at the surface and extend to varying depths below existing grades. For an estimation on the depth and extent of soft soils, the N-values provided on the boring logs should be reviewed. Previous experience indicates soils with an N-value exceeding 10 typically perform adequately for proof rolling with minor reworking and recompaction. Soils with lower values often require undercut or stabilization to facilitate construction. As indicated on the boring logs, a minimum of 2.0 to 3.0 feet of soft soils were identified in the borings. Varying amounts of undercut or stabilization should be anticipated.

Beginning sitework in summer or drier months would be beneficial in limiting the amount of required undercut. In any case, soils that exhibit rutting or pumping when proof rolled will require stabilization or undercut. The subgrade should be prepared adequately to pass a proof roll. Stabilization efforts could include scarifying, drying and recompaction, but could prove difficult in winter months or areas where soft soils are deeper than 2.0 to 3.0 feet. Undercut of soft soils to firm, stable subgrade may be required depending on construction schedule and climatic conditions.

Fill Placement:

Select fill should be granular, non-expansive type soils having a PI between 5 and 20 that are stable after placement. Locally available clay gravel (GC) or clay sand (SC) are acceptable materials, however, other material may be used if approved by the engineer. All fill should be placed in 8.0-inch thick loose lifts, moisture conditioned to -1% to +3% of optimum, and be compacted to 98% of Standard compaction as per ASTM D 698. At no time should the particle size of the material exceed the lift thickness.

The compaction and moisture content of fill materials should be verified through field density tests per ASTM D 6938. One test per lift should be performed for every 2500 square feet of building area, but could be increased to 5000 to 10,000 square feet for any parking or drive areas. It would be prudent to require in the specifications the performance of Atterberg limits of fill materials during placement to ensure compliance with the criteria outlined herein as borrow pit soils may vary significantly across the pit.

Excavation Criteria:

The soils encountered should be excavated with normal tracked excavators. No conditions were encountered over the depths investigated that would indicate difficulty with excavations. Trench excavations for utilities should be completed with normal excavation equipment. The shallow soils could be prone to sloughing or cave-ins due to the presence of perched water. These materials are saturated, and thus, some cave-ins are likely. Based on OSHA regulations (29 CFR 1926, Subpart P) regarding soil classification for trench excavations, the shallow soils encountered would best classify as Type C. In any case, OSHA regulations regarding shoring or benching of excavations should be considered during construction. Backfilling trench excavations should satisfy the criteria given previously, though ARDOT approved flowable fill may be used as an alternative for confined spaces provided it is allowed to properly cure.

Adverse Weather Conditions:

Site grading and earthwork operations will be more difficult in wet or winter months. Should earthwork operations for the project begin in the time period of November through April, the owner should anticipate and budget for additional expenses for earthwork. Not only will more frequent and saturating rains be prevalent during these months, ambient air conditions are not conducive to drying of site soils. Efficient aeration and drying of soils is dependant upon high temperatures, low humidity, and the contractor's ability to disc or scarify the soils. Aeration and drying of on site soils will require additional effort by the contractor and should be considered during budgeting or planning. Though these operations could limit the amount of bridge lift required, they will not reduce the specified amounts of fill required to reduce shrinkage/swell of the on-site soils.

Should the owner or contractor elect to begin earthwork in wet or winter months, undercut of soft soils will likely be the most feasible option. Mechanical stabilization of the on site soils is possible and could include the use of a geotextile fabric/grid to bridge over soft soils and provide support to subsequent fill. Implementation of a geotextile can be addressed once the grading plan for the project is near completion. Chemical stabilization through lime or fly ash worked into wet soils can also be effective. However, these methods are highly dependant upon the contractor's expertise, equipment, and proper installation or mixing methods. In any case, the proposed construction area should be maintained in a well drained condition during construction. Water should not be allowed to stand or pond on areas of exposed earthwork. In anticipation of rainfall, it would be prudent for the contractor to "seal" exposed subgrades with a smooth drum roller to promote runoff. Additionally, surface drainage control features such as stormwater ponds should be installed as soon as it is practical.

FOUNDATIONS

Conventional shallow foundations (strip/spread) are considered the most feasible foundation option for the proposed building based on the anticipated loadings, site conditions, and earthwork criteria established in the previous section. The following discussion will provide bearing capacity, settlement, and other criteria typically required for in design. For the purposes of this report, bearing capacity refers to the net allowable bearing capacity, which is defined by the ultimate bearing capacity (factored dead and live loads) reduced by an acceptable factor of safety, which for this project is considered to be 2.0. Additionally, shape, inclination, groundwater depth, and other design factors are considered minimal and no reduction in bearing capacity are necessary for these conditions.

Bearing Capacity:

Based on the results of our field investigation a bearing capacity of 2000 psf should be applicable for exterior footings bearing in adequate natural ground or select compacted fill. This value was determined based on the N-values from the borings and our in-house bearing capacity calculations. It should be noted that the provided bearing capacity is applicable only if all criteria in the **EARTHWORK** section is met or exceeded. Interior footing depths may be decreased, so long as they satisfy local building codes, but should still bear in adequate natural ground or properly compacted select fill below the 10.0-inch local frost zone.

Settlement:

The settlement of the foundations must be within tolerable limits, which should be established by the structural engineer, but have not been provided prior to this investigation. The potential settlement for conventional footings was estimated from results of Standard Penetration tests

performed during drilling. The magnitude of total settlement for conventional footings at the recommended bearing capacities and depths were estimated to be on the order of 1.00 inch. A differential settlement of 0.50 inch is recommended for use in the structural design. Should the bearing capacity or loads used in design differ from those indicated herein, the amount of settlement will vary accordingly.

Other Design Considerations:

The bearing capacity and settlement discussions provided previously assume that the structural loadings are positioned such that a relatively uniform bearing pressure is exerted to the bearing strata. Eccentric, inclined or other loadings that result in a non-uniform bearing pressure will require further evaluation by this firm once specific loading conditions are established. In any case, it would be prudent to increase the rigidity of the foundation in an effort to minimize potential differential movements. An increase in rigidity can be achieved by techniques that would increase the section modulus of the foundation members. Column and wall footings should be designed in accordance with the requirements of the various applicable codes.

Resisting uplift loads should consider the weight of the footing and overlying soil backfill. A minimum factor of safety of 1.5 is recommended when calculating uplift resistance. For resistance of lateral forces, a net allowable passive resistance of 250 psf can be used for the portion of the footing extending below 1.5 feet. A coefficient of sliding resistance of 0.40 may be used by the designer to calculate frictional resistance along the bottom surface of the footing.

Excavation/Monitoring:

The excavations for footings should be performed with equipment capable of providing a clean bearing surface. It would be ideal for the bottom 6.0 inches of the excavation be achieved with a smooth plate excavator, or hand labor. Reinforcing steel and concrete should be placed as soon as possible upon completion of the geotechnical representative evaluation, as described below. All debris, standing water and mud, including saturated soils, should be removed. In no instance should concrete be placed in frozen or saturated soils. If unforeseen circumstances require excavations to remain open for an extended period, a thin "mud slab" may be placed in an effort to reduce disturbance to the bearing strata. In this case, the excavation should extend a minimum of 2.0 inches below planned depth, allowing a thin layer of concrete the same strength as required for the footings to be placed.

The performance of the foundation system will partially depend on the quality of construction. It would be prudent to have further evaluations by the soils engineer, or his representative, to verify that the design bearing value has been achieved in footing excavations. Furthermore, the condition

of the subgrade should be evaluated to insure cleanliness and uniformity of bearing strata immediately prior to concrete placement. Bearing capacity can be verified by the use of a static cone penetrometer, or other acceptable means designated by the soils engineer.

FLOOR SLABS

Differential movement of the floor slab may be caused by a difference in the allowable gross bearing capacity, differing heave conditions, and/or variable thicknesses of compressible soils below the floors. The stiffness effect of a well compacted subgrade and/or engineered fill in conjunction with a granular base, collectively known as the soil support system, should greatly diminish the differential floor slab movements to tolerable limits. Variable amounts of undercut will likely be required due to the presence of soft soils. Based on the anticipated grades it appears that the soil support system will consist of compacted select fill and/or moisture conditioned compacted natural ground overlain by a free-draining granular fill. For this condition the designer should consider a modulus of subgrade reaction (k) of 100.0 pci over the top 8.0 inches of subgrade. The floor slabs and soil support system should be designed and constructed in accordance with American Concrete Institute (ACI) Publications 302.1R-15, Guide for Concrete Floor and Slab Construction, and 360R-10, Guide to Design of Slabs-on-Ground, and other applicable codes.

Subgrade Preparation:

Initially, the recommendations in the **EARTHWORK** section, including proof rolling and moisture/compaction testing, should be followed to prepare the subgrade. However, the designer should specify that after destructive/intrusive construction activities, such as weathering, construction traffic, and utility placement, the contractor be required to restore the top 8.0 inches of subgrade to its specified moisture, density, and grade control immediately prior to slab placement. This rehabilitation should be verified through quality control testing and a rod and level survey, as directed by ACI 302.1R-15, Subsection 6.1. This will aid in prevention of post construction slab movements induced by moisture variations inherent to any soil type, especially for exposed or polished floors with no covering.

Granular Base:

As per ACI 302.1R-15, Subsection 6.1.4, the granular base should consist of a clean, densely graded granular material with a balanced fine content that produces a low-friction surface while minimizing wicking. This material should have 100% passing the 1½ inch (38 mm) sieve, 15% to 50% passing the No. 4 (4.75 mm) sieve, and less than 12% passing the No. 200 (75 µm) sieve or satisfy the requirements of ASTM D1241 with the modification allowance of less than 12% passing the No. 200 (75 µm) sieve. Additionally, the material passing the No. 200 (75 µm) sieve should be clean

granular fill with less than 3% clay or friable particles. It should be noted, the ACI code states that clean/cushion/concrete sand “meeting ASTM C33/C33M, will not be adequate”. The base material should be placed and compacted with adequate quality control testing and grade control that conforms to ACI 117 with verification by rod and level survey.

Vapor Membrane:

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. However, if any of the above sensitivity issues apply, placement of a minimum 10-mil vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) may require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty. The architect/engineer should decide on a case-by-case basis whether to place the vapor membrane above or below the granular layer. The guidelines in ACI 302.1R-15, Subsection 6.1.5, and ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials, should be considered when determining the location of vapor membranes and the relation to floor finishes, project conditions, schedule, and the potential effects of slab curling and cracking.

DRIVES AND PARKING AREAS

The following pavement designs and pavement recommendations are based on numerous reasonable assumptions concerning the pavement use, site conditions, and maintenance. The existing natural ground after stripping of all surface features, topsoil, organic root zone, and any near surface debris will perform satisfactorily as subgrade for the pavement structures provided it passes a proof roll. An estimated CBR of 3 was determined for the near surface soils based on SPT values obtained from borings in the parking area of the site. Based on the CBR value of 3 upper 8.0 inches of natural ground will require scarifying, moisture conditioning, and compaction to 98% ASTM D 698 to form a stable subgrade for base placement. Variable amounts of undercut will likely be required due to the presence of soft soils. The base material and surface material thicknesses and construction procedures are provided in the following sections.

Flexible Pavement:

Flexible pavement typically consists of asphalt cement hot mix (ACHM) as specified by Section 407 of the Standard Specifications for Highway Construction (Edition of 2003) as published by the Arkansas Department of Transportation. The design requirements for ACHM surface course; 12.5 mm (Type II) and 9.5 mm (Type III) are provided in Tables 407-1 and 407-2, respectively. ACHM is most commonly used for light to moderate traffic areas including straight drives and

parking areas for light vehicles. It should not be used in traffic lanes where trucks turn, backup, or pickup trash dumpsters. Based on the subgrade CBR of 3 and a minimum of 8.0 inches of compacted subgrade the following sections will apply for light and heavy duty sections. The recommended pavement structures are shown on Plate 13.

<u>LIGHT</u>		<u>HEAVY</u>	
<u>Material</u>	Thickness (inches)	<u>Material</u>	Thickness (inches)
12.5 mm ACHM	2.0	12.5 mm ACHM	3.0
Class 7 Base	6.0	Class 7 Base	8.0

NOTES:

- 1) Class 7 - 90% crushed stone meeting ARDOT Table 303-1.
- 2) Compaction of ACHM should not be less than 90% of theoretical design mix.
- 3) Base material compaction should not be less than 100% ASTM D 698.

Rigid Pavement Non-Reinforced:

Rigid pavements or Portland Cement Concrete (PCC) pavements consists of concrete materials and construction procedures as specified by Section 501 of the Standard Specifications for Highway Construction (Edition of 2003) as published by the Arkansas Department of Transportation. The material type and design requirements including admixtures, reinforcing, dowels, jointing, curing, and finish are provided therein. Rigid (PCC) pavements are commonly used for both light and heavy duty traffic applications. Minimally, approach slabs, truck turning areas, docks, and dumpster pads should be PCC. Based on the site subgrade CBR of 3 and a modulus of subgrade reaction of 100.0 pci over the minimum of 8.0 inches of compacted subgrade, the following sections will apply for both light and heavy duty pavement sections. The recommended pavement structures are shown on Plate 13.

<u>LIGHT</u>		<u>HEAVY</u>	
<u>Material</u>	Thickness (inches)	<u>Material</u>	Thickness (inches)
PCC	5.0	PCC	7.0
Class 7 Base	4.0	Class 7 Base	6.0

NOTES:

- 1) Class 7 - 90% crushed stone meeting ARDOT Table 303-1.
- 2) PCC strength to be 4000 psi at 28 days.
- 3) PCC to be entrained with 5% air.
- 4) Load transfer, dowels, and joints per ACI, ARDOT or PCA guidelines.
- 5) PCC should be increased to 10.0 inches for dumpster approaches and pads.

Pavement Performance/Maintenance

The long term pavement performance will be directly related to several factors such as adequate edge drainage and surface drainage which does not allow water to accumulate on the pavement surface or behind the curbs and pavement edges. All pavement joints must be sealed and should be placed parallel to the overall site drainage direction. All irrigation, water, and other utility lines should be carefully monitored to insure they do not contribute to premature pavement failure by allowing water to migrate onto or under the pavements. Adequate quality control testing including proof rolling, compaction testing, thickness testing of base and ACHM as well as compaction of the ACHM is critical to successful long term pavement performance. In addition, pavements will require regular maintenance such as periodic surface sealing and crack sealing to prolong the desired performance and life.

QUALITY CONTROL

Quality control testing should be utilized in all phases of the construction. To verify that the proper performance of the proposed structures, all fill required should be compacted to a minimum of 98% Standard compaction, in accordance with ASTM D 698. The foundation excavations should be evaluated to verify that the recommended bearing capacity has not been reduced by disturbance to excavation or massive imperfections in the bearing strata. A geotechnical engineering representative should be present to evaluate the bottom of the foundation excavations prior to placement of concrete. Our recommendations are based upon adequate quality control testing being utilized and further evaluations and reviews during the construction phase of the project.

CONCLUSIONS AND RECOMMENDATIONS

As a result of this geotechnical investigation, the following recommendations are offered for consideration:

1. As previously discussed, conventional footings are suitable foundations for the proposed structure. It is recommended that the foundation be designed in accordance with the necessary structural and/or architectural requirements determined by the designers.
2. The allowable bearing capacity for the conventional footing is 2000 psf at a minimum depth of 2.0 feet below finished grade on adequate natural ground or properly compacted select fill.
3. All fill shall be placed in 8.0-inch thick lifts and be compacted within -1% and +3% of optimum moisture content to 98% Standard Proctor density as per ASTM D 698. The select fill shall be non-expansive, granular type soils with a PI between 5 and 20 per ACI 360R.
4. As an additional measure perimeter surface drainage and should be assured around the exterior of the building to intercept and drain surface runoff water from the near surface and foundation supporting soils. It would also be a prudent measure to slope backfill soils away from foundations walls.

5. The use of flexible or rigid pavements should be a function of the anticipated traffic use as determined by the designer using the recommended sections provided on pages 10 and 11 of this report. As a minimum PCC pavements should be used for truck lanes, dumpster pads, and turn in areas.
6. Quality control testing should be utilized in the construction of the foundation, undercutting, fill placement, and floor slab construction with adequate testing to verify that the design requirements have been achieved.
7. Geotechnical engineering services by a qualified firm are recommended during the foundation construction phase so that adequate compensation can be made for conditions that may occur which differ significantly from those assumed as a result of this investigation.
8. Other recommendations are given throughout the text of this report.

LIMITATIONS

The boring logs shown in this report contain information related to the types of soil or rock encountered at specific locations and times and show lines delineating the interface between these materials, as well as results of tests performed in the laboratory on representative samples. The logs also contain our field geologist's interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both factual and interpretative information. It is not warranted that these logs are representative of subsurface conditions at other locations and times.

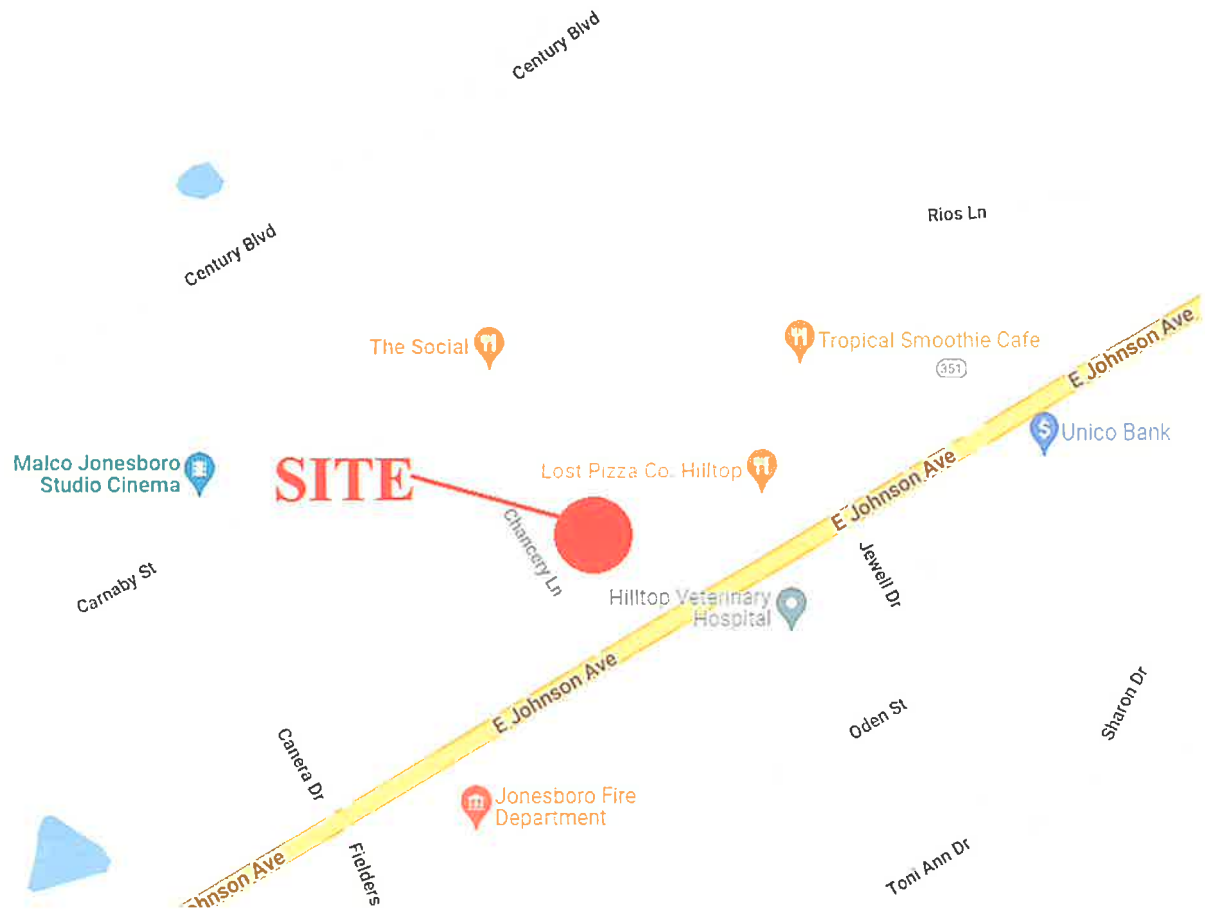
The analyses, conclusions, and recommendations contained in this report are based on site conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site. If, during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and provide new recommendations as becomes necessary. Recognize that both natural and manmade events may have changed site conditions since issuance of this report and further review may result. If after submission of this report structural loads or finished grades are changed from those that were assumed, we urge that we be promptly informed, and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse. Further, we request that our firm be retained to review those portions of the plans and specifications for this particular project that pertain to earthwork and foundations as a means to determine whether the plans and specifications are consistent with the recommendations contained in the report. The conclusions and recommendations contained herein are based on several assumptions regarding grades, anticipated loads, and location of the structure. It is understood that specific information was unavailable at this early stage of

planning. It is strongly recommended that this firm be provided a copy of the plans for review upon completion. An in-depth review is considered necessary to verify the recommendations included in the text and their suitability in the final design.

It should be understood that there is the possibility that even with the proper application of current engineering principles, conditions may exist on the site that could not be identified within the scope of this investigation or which were not reasonably identifiable from the available information. The conclusions and recommendations in this report contain all the limitations inherent to the principles and practice of geotechnical engineering. AECI has not performed any observations, investigation, study, or testing that is not specifically listed in the scope of services. Thus, AECI shall not be liable for failing to discover any condition whose discovery required the performance of services outside of the scope of services provided in our proposal.

* * * * *

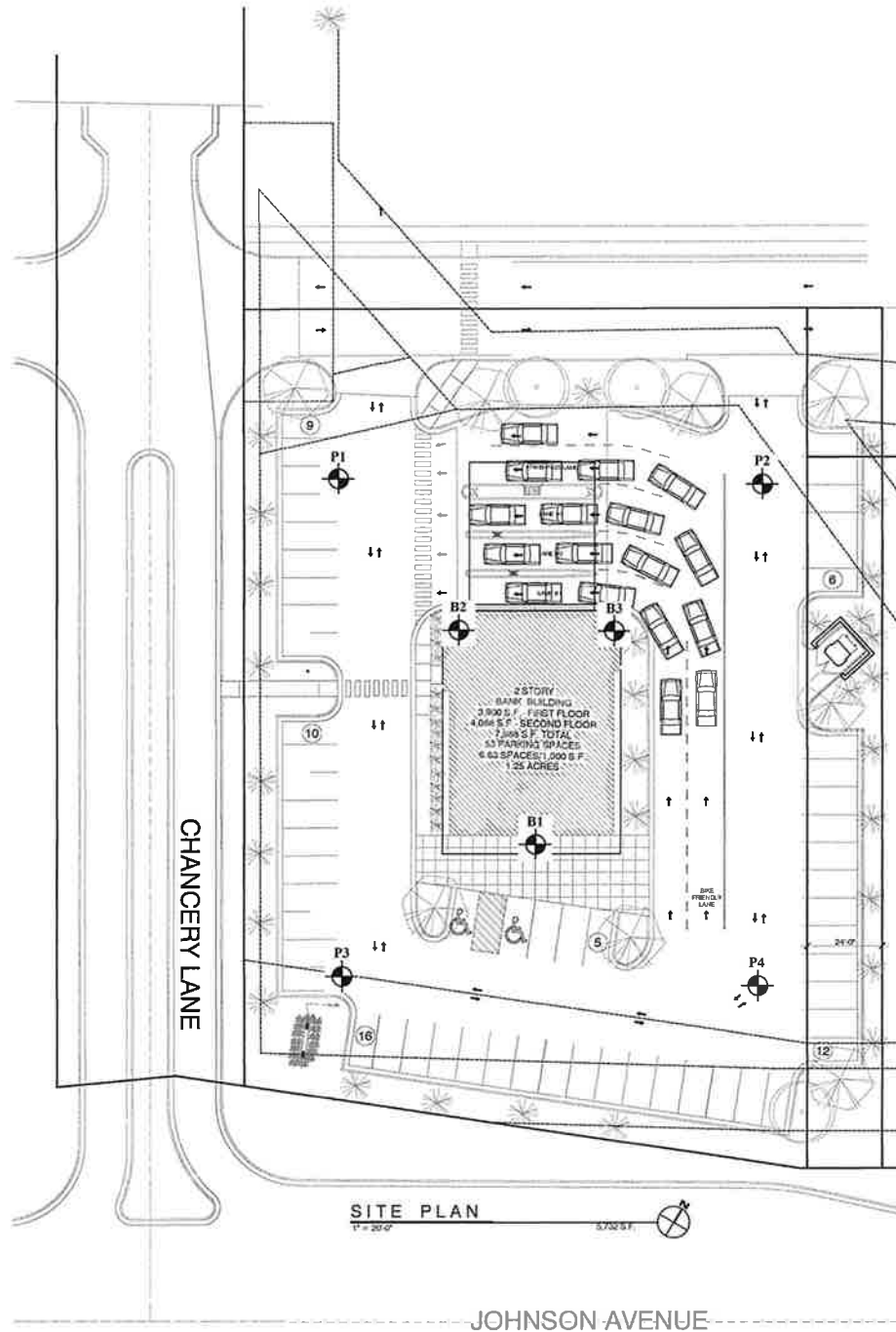
APPENDIX A
PLATES



VICINITY MAP

JONESBORO, ARKANSAS

NOT DRAWN TO SCALE.



PLAN OF BORINGS

NORTH

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LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: B1
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				Core	Standard Penetration	J - Jar
				Static Water Table	Hydrostatic Water Table	No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	7		MEDIUM STIFF TO HARD MOIST BROWN CLAY (CL) PP = 0.75 KSF		
	P2	11		CONTINUES (CL) PP = 1.25 KSF		
5	P3	31		CONTINUES (CL) PP = 3.25 KSF		
	P4	34		CONTINUES (CL) PP = 3.50 KSF		
10	P5	37		CONTINUES (CL) PP = 3.75 KSF		
15	P6	55		VERY DENSE MOIST BROWN SILTY SAND (SM)		
20				BOTTOM OF HOLE AT 15.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: B2
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	⊠ Standard Penetration	▤ J - Jar
				▽ Static Water Table	▼ Hydrostatic Water Table	▦ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	7		MEDIUM STIFF TO VERY STIFF MOIST BROWN CLAY (CL) PP = 0.75 KSF		
	P2	15		CONTINUES (CL) PP = 1.50 KSF		
5	P3	27		CONTINUES (CL) PP = 2.75 KSF		
	P4	24		CONTINUES (CL) PP = 2.50 KSF		
10	P5	26		CONTINUES (CL) PP = 2.75 KSF		
15	P6	35		DENSE MOIST BROWN SILTY SAND (SM)		
20				BOTTOM OF HOLE AT 15.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: B3
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	⊞ Standard Penetration	▢ J - Jar
			▼ Static Water Table	▼ Hydrostatic Water Table	▣ No Recovery	
VISUAL DESCRIPTION OF STRATUM						
0	P1	4		SOFT TO VERY STIFF MOIST BROWN CLAY (CL) PP = 0.50 KSF		
	P2	13		CONTINUES (CL) PP = 1.50 KSF		
5	P3	24		CONTINUES (CL) PP = 2.50 KSF		
	P4	25		CONTINUES (CL) PP = 2.50 KSF		
10	P5	28		CONTINUES (CL) PP = 2.75 KSF		
15	P6	35		DENSE MOIST BROWN SILTY SAND (SM)		
20				BOTTOM OF HOLE AT 15.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE **BORING NO:** P1
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	☒ Standard Penetration	☐ J - Jar
				▽ Static Water Table	▼ Hydrostatic Water Table	☐ No Recovery
				VISUAL DESCRIPTION OF STRATUM		
0	P1 P2 P3	5		MEDIUM STIFF TO VERY STIFF MOIST BROWN CLAY (CL) PP = 0.50 KSF		
		16		CONTINUES (CL) PP = 1.75 KSF		
5		24		CONTINUES (CL) PP = 2.50 KSF		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
10						
15						
20						
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: P2
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	☒ Standard Penetration	☐ J - Jar
				▽ Static Water Table	▼ Hydrostatic Water Table	☒ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	8		MEDIUM STIFF TO VERY STIFF MOIST BROWN CLAY (CL) PP = 1.00 KSF		
	P2	10		CONTINUES (CL) PP = 1.00 KSF		
5	P3	27		CONTINUES (CL) PP = 2.75 KSF		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
10						
15						
20						
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: P3
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	☒ Standard Penetration	☐ J - Jar
				▼ Static Water Table	▼ Hydrostatic Water Table	☒ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	7		MEDIUM STIFF TO VERY STIFF MOIST BROWN CLAY (CL) PP = 0.75 KSF		
	P2	14		CONTINUES (CL) PP = 1.50 KSF		
5	P3	19		CONTINUES (CL) PP = 2.00 KSF		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
10						
15						
20						
25						

LOG OF BORING

PROJECT: FIRST COMMUNITY BANK-GREENSBORO VILLAGE BORING NO: P4
JONESBORO, ARKANSAS

FOR: FIRST COMMUNITY BANK

LOCATION: SEE PLAN OF BORINGS

DATE: 03/06/22

JOB NO: 17044

BORING TYPE: AUGER/WASH/SPT

DRILLER: JOHNSON
HILYARD ATV

GEOTECHNICIAN: JOHNSON

GROUND ELEVATION: NOT FURNISHED

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				■ Core	⊞ Standard Penetration	▢ J - Jar
			▼ Static Water Table	▼ Hydrostatic Water Table	▣ No Recovery	
VISUAL DESCRIPTION OF STRATUM						
0						
	P1	7		MEDIUM STIFF TO VERY STIFF MOIST BROWN CLAY (CL) PP = 0.75 KSF		
	P2	12		CONTINUES (CL) PP = 1.25 KSF		
5	P3	22		CONTINUES (CL) PP = 2.25 KSF		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER WAS ENCOUNTERED IN THIS BORING.		
10						
15						
20						
25						

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 0 to 4 blows/ft.
Loose	- 4 to 10 blows/ft.
Medium Dense	- 10 to 30 blows/ft.
Dense	- 30 to 50 blows/ft.
Very Dense	- over 50

Particle Size Identification

Boulders	- 8-inch diameter or more
Cobbles	- 3 to 8-inch diameter
Gravel	- Coarse - 1 to 3-inch
	Medium - 1/2 to 1-inch
	Fine - 1/4 to 1/2-inch
Sand	- Coarse - 0.6 mm to 1/4-inch (dia. of pencil lead)
	Medium - 0.2 mm to 0.6 mm (dia. of broom straw)
	Fine - 0.05 mm to 0.2 mm (dia. of human hair)
Silt	- 0.06 mm to 0.002 mm (Cannot see particles)

Relative Proportions

<u>Descriptive Term</u>	<u>Percent</u>
Trace	1 to 10
Little	11 to 20
Some	21 to 35
And	36 to 50

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very Soft	- < 2 blows/ft.
Soft	- 2 to 4 blows/ft.
Medium Stiff	- 4 to 8 blows/ft.
Stiff	- 8 to 15 blows/ft.
Very Stiff	- 15 to 30 blows/ft.
Hard	- over 30

Plasticity

<u>Degree of Plasticity</u>	<u>Plasticity Index</u>
None to slight	0 to 4
Slight	5 to 7
Medium	8 to 22
High to Very High	over 22

NOTES

Classification - The classifications given on the logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0-inch O.D., 1 3/8-inch I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30.0 inches. It is customary for AECl to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example: 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e., 8 + 9 = 17 blows/ft.).

Strata Changes - In the column "Soil Descriptions" on the drill log the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (- - -) represents an estimated change.

Groundwater - The groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

KEY TO SOIL CLASSIFICATIONS AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM ⁽¹⁾					TERMS CHARACTERIZING SOIL STRUCTURE ⁽²⁾
Major Divisions	Letter	Symbol		Name	
		Hatching	Color		
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	RED	Well-graded gravels or gravel-sand mixtures, little or no fines	SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.
		GP		Poorly-graded gravels or gravel-sand mixtures, little or no fines	FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
		GM	YELLOW	Silty gravels, gravel-sand-silt mixtures	LAMINATED (VARVED) - composed of thin layers of varying color and texture, usually grading from sand or silt at the bottom to clay at the top.
		GC		Clayey gravels, gravel-sand-clay mixtures	CRUMBLY - cohesive soils which break into small blocks or crumbs on drying.
	SAND AND SANDY SOILS	SW	RED	Well-graded sands or gravelly sands, little or no fines	CALCAREOUS - containing appreciable quantities of calcium carbonate, generally nodular.
		SP		Poorly-graded sands or gravelly sands, little or no fines	WELL GRADED - having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
		SM	YELLOW	Silty sands, sand-silt mixtures	POORLY GRADED - predominantly of one grain size (uniformly graded) or having a range of sizes with some intermediate size missing (gap or skip graded).
		SC		Clayey sands, sand-clay mixtures	
FINE GRAINED SOILS	SILTS AND CLAYS LL<50	ML	GREEN	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	SYMBOLS FOR TEST DATA M/C = 15 - Natural moisture content in percent. γ = 95 - Dry unit weight in pounds/cubic foot. Qu = 1.23 - Unconfined compression strength in tons/square foot. Qc = 1.68 (21 psi) - Confined compression strength at indicated lateral pressure. 51-21-30 - Liquid limit, Plastic limit, and Plasticity index. 30% FINER - Percent finer than No. 200 mesh sieve. 30 B/F - Blows per foot, Standard Penetration test. ▼ - Hydrostatic water table. ▽ - Static water table.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL		Organic silts and organic silt-clays of low plasticity	
	SILTS AND CLAYS LL>50	MH	BLUE	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		CH		Inorganic clays of high plasticity, fat clays	
		OH		Organic clays of medium to high plasticity, organic silts	
HIGHLY ORGANIC SOILS	Pt		ORANGE	Peat and other highly organic soils	

TERMS DESCRIBING CONSISTENCY OF SOILS⁽²⁾

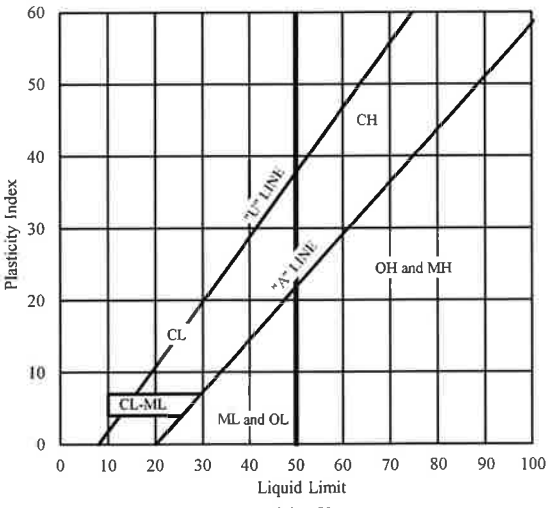
COARSE GRAINED SOILS		FINE GRAINED SOILS		
DESCRIPTIVE TERM	NO. BLOWS/FOOT STANDARD PEN. TEST	DESCRIPTIVE TERM	NO. BLOWS/FOOT STANDARD PEN. TEST	UNCONFINED COMPRESSION TONS PER SQ. FT.
Very Loose	0 - 4	Very Soft	<2	<0.25
Loose	4 - 10	Soft	2 - 4	0.25 - 0.50
Firm (medium dense)	10 - 30	Plastic (medium stiff)	4 - 8	0.50 - 1.00
Dense	30 - 50	Stiff	8 - 15	1.00 - 2.00
Very Dense	over 50	Very Stiff	15 - 30	2.00 - 4.00
		Hard	over 30	over 4.00

Field classification for "Consistency" is determined with a 0.25-inch diameter penetrometer.

(1) - From Waterways Experiment Station Technical Memorandum No. 3-357

(2) - From "Soil Mechanics in Engineering Practice" by Terzaghi and Peck

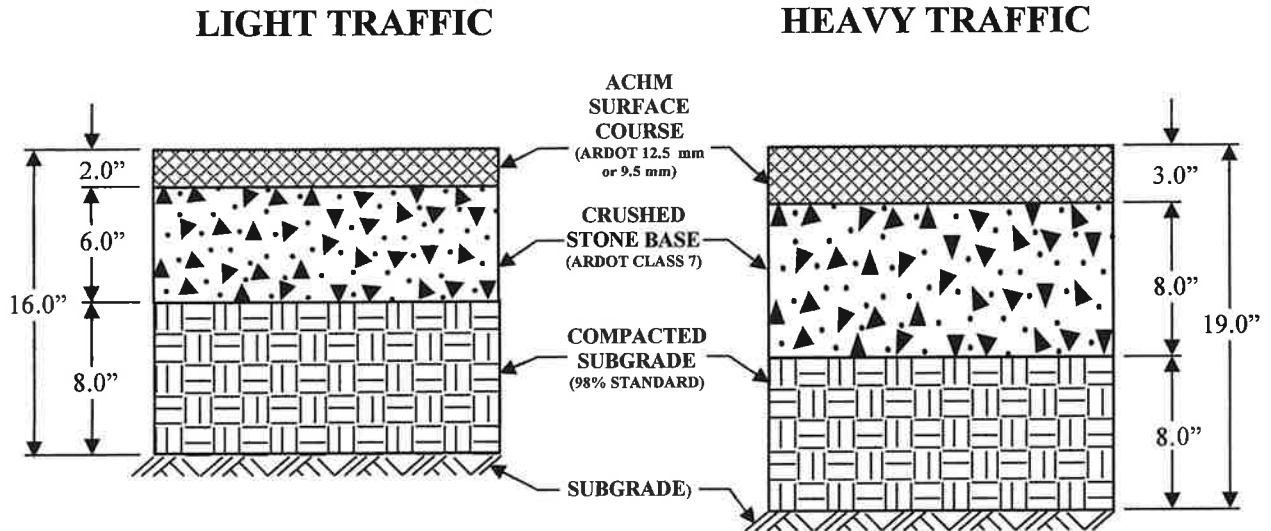
UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major divisions		Group Symbols	Typical Names	Laboratory Classifications Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4	
				$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 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	Atterberg limits below "A" line or P.I. less than 4	
				Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
				$C_u = \frac{D_{60}}{D_{10}}$ greater than 4	
		SW	Well-graded sands, gravelly sands, little or no fines	$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
				Not meeting all gradation requirements for SW	
	Sands with fines (Appreciable amount of fines)	SP	Poorly graded sands, gravelly sands, little or no fines	Atterberg limits below "A" line or P.I. less than 4	
				Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silt and clays (Liquid limit less than 50)	SM*	Silty sands, sand-silt mixtures	Atterberg limits above "A" line with P.I. greater than 7	
				Atterberg limits above "A" line with P.I. greater than 7	
		SC	Clayey sands, sand-clay mixtures		
	Silt and clays (Liquid limit greater than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
		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		
		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
		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		

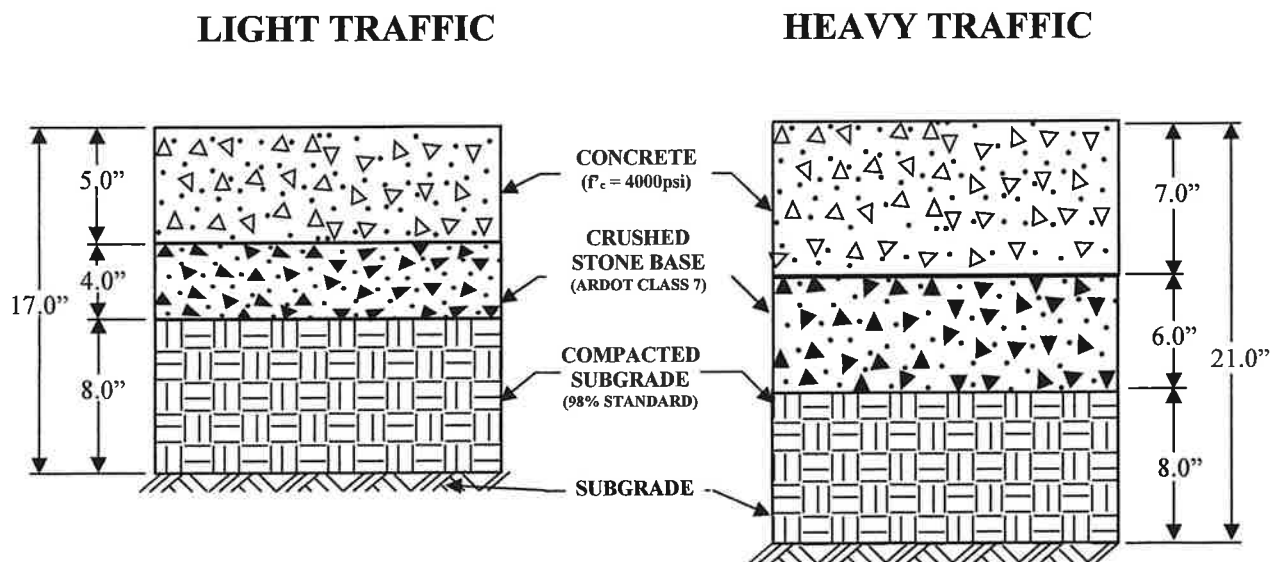
*Division of GM and SM groups into subdivisions of d and u are for roads and airfield only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; u used when L.L. is greater than 24.

**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

RECOMMENDED FLEXIBLE PAVEMENT STRUCTURE



RECOMMENDED RIGID PAVEMENT STRUCTURE



APPENDIX B
SUPPORTING LABORATORY DATA

MOISTURE CONTENT DETERMINATION
ASTM D 2216

Project: FIRST COMMUNITY BANK - GREENSBORO VILLAGE **Project No.:** 17044
Location: JONESBORO, ARKANSAS **Date:** 03/15/22

MOISTURE CONTENT					
Sample Number	B1;P1	B1;P2	B1;P3	B2;P1	B2;P3
Tare Number	NP	B44	F1	E20	R
Tare + Wet Soil (g)	157.14	167.67	158.48	165.15	151.25
Tare + Dry Soil (g)	128.38	126.27	131.41	134.79	126.20
Tare (g)	11.72	10.34	10.99	11.19	11.83
Water (g)	28.76	41.40	27.07	30.36	25.05
Dry Soil (g)	116.66	115.93	120.42	123.60	114.37
Water Content (%)	24.65	35.71	22.48	24.56	21.90

ATTERBERG LIMIT DETERMINATION
ASTM D 4318

Project: FIRST COMMUNITY BANK - GREENSBORO VILLAGE

Project No.: 17044

Location: JONESBORO, ARKANSAS

Date: 03/16/22

LIQUID LIMIT

Sample Number	B1;P1	B1;P3	B2;P2	B3;P1	P1;P1
Tare Number	81F	KH	T58	H57	868
Number of Blows	25	23	28	27	28
Tare + Wet Soil (g)	17.36	22.65	25.73	24.37	27.21
Tare + Dry Soil (g)	14.49	18.64	20.25	18.84	21.77
Tare (g)	6.77	6.82	6.75	6.77	6.76
Water (g)	2.87	4.01	5.48	5.53	5.44
Dry Soil (g)	7.72	11.82	13.50	12.07	15.01
Water Content (%)	37.18	33.93	40.59	45.82	36.24
Liquid Limit	37	34	41	46	37

PLASTIC LIMIT

Sample Number	B1;P1	B1;P3	B2;P2	B3;P1	P1;P1
Tare Number	56	LP	XA	MC	97
Tare + Wet Soil (g)	18.35	17.71	16.82	17.63	18.02
Tare + Dry Soil (g)	16.88	16.19	15.45	16.06	16.45
Tare (g)	8.01	8.04	8.00	7.85	8.23
Water (g)	1.47	1.52	1.37	1.57	1.57
Dry Soil (g)	8.87	8.15	7.45	8.21	8.22
Water Content (%)	16.57	18.65	18.39	19.12	19.10
Plastic Limit	17	19	18	19	19
Plasticity Index	20	15	23	27	18
Classification (#40)	CL	CL	CL	CL	CL

MECHANICAL GRAIN SIZE ANALYSES
ASTM D 1140

Project: FIRST COMMUNITY BANK - GREENSBORO VILLAGE
Location: JONESBORO, ARKANSAS
Sample No.: B1;P2
Soil Description: REDDISH BROWN LEAN CLAY

Project No.: 17041
Date: 03/16/22
Sample Depth: 2.5'-4'

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	20.7	20.7	7.1	92.9
PAN	272.6	293.3	100.0	0.0
Percent Sample Gravel/Sand:		7.1	Sample Weight: 293.3	
Percent Sample Silt/Clay:		92.9	Washing Loss: 272.6g	

Project: FIRST COMMUNITY BANK - GREENSBORO VILLAGE
Location: JONESBORO, ARKANSAS
Sample No.: B1;P6
Soil Description: REDDISH BROWN SILTY SAND

Project No.: 17041
Date: 03/16/22
Sample Depth: 15'-16.5'

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	242.8	242.8	83.8	16.2
PAN	47.1	289.9	100.0	0.0
Percent Sample Gravel/Sand:		83.8	Sample Weight: 289.9	
Percent Sample Silt/Clay:		16.2	Washing Loss: 47.1g	

SHRINKAGE / SWELL INDEX TESTS

Project:	FIRST COMMUNITY BANK - GREENSBORO VILLAGE	Project No.:	17044
Location:	JONESBORO, ARKANSAS	Date:	03/15/22
Sample No.:	B3;P2	Sample Depth:	2.5'-4'
Soil Description:	REDDISH BROWN LEAN CLAY	K PRC:	2.0

Liquid Limit:	NA	Est. Specific Gravity:	2.67
Plastic Limit:	NA	No. of Layers:	3
Plasticity Index:	NA	No. Blows/Layer:	7

WATER CONTENT

	Before Test		After Test
Tare Number	G1	Tare Number	BC164
Tare + Wet Soil	149.4 g	Tare + Wet Soil	139.2 g
Tare + Dry Soil	124.8 g	Tare + Dry Soil	117.7 g
Tare	11.7 g	Tare	21.8 g
Water Content	21.7 %	Water Content	22.4 %
Saturation	95.8 %	Saturation	98.9 %
Dry Density	103.7 pcf	Dry Density	103.7 pcf

VOID RATIO DETERMINATION

Vo	57.786 ccm	Vf	57.786 ccm
Wt of Soil + Ring	350.0 g	Wt of Soil + Ring	350.6 g
Wt of Ring	233.0 g	Wt of Ring	233.0 g
Moist Wt of Soil	117.0 g	Moist Wt fo Soil	117.6 g
Vs	35.993 ccm	Vs	35.993 ccm
Eo	0.6055	Ef	0.6055

SWELL DATA

Time	Dial (* 0.0001)	Pressure	Void Ratio
13.57	0.00	0.0	0.6893
14.10	0.00	0.0	0.6893
14.35	0.00	0.0	0.6893
15.10	0.00	0.0	0.6893
16.00	0.00	0.0	0.6893
24.45	0.00	0.0	0.6893

Final Dial Reading: 0.00

Swell Pressure: **0 PSF**

Heave = 0.000 % = 0.0000 inches/foot

SHRINKAGE DATA

Linear Shrinkage (Bar Method):

Linear Shrinkage: **5.6 %**

Volumetric Shrinkage: **15.9 %**

BID FORM

To: First Community Bank
Mr. Dale Cole

Project: A New Facility for
First Community Bank
Hwy. 62/412 and Big Creek Road
Jonesboro, AR

Date:

Submitted by:
(full name and address)

1. OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

\$.....dollars, in lawful money of the United States of America.

We have included, the security Bid Bond as required by the Instruction to Bidders.

All applicable taxes are included in the Bid Sum.

All Cash Allowances described in Section 01 20 00 are included in the Bid Sum.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will:

- Execute the Agreement within ten days of receipt of Notice of Award.
- Furnish the required bonds and insurance within ten days of receipt of Notice of Award.
- Commence work within ten days after written Notice to Proceed.

If this bid is accepted within the time stated, and we fail to commence the Work, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If this Bid is accepted, we will:

- Complete the Work in(.....) calendar days from Notice to Proceed.

4. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

Addendum # Dated

Addendum # Dated

Addendum # Dated

Addendum # Dated

Addendum # Dated

Addendum # Dated

5. APPENDICES

The following documents are attached to and made a condition of the Bid:

Bid security in form of

Document 00 43 00 including:

Appendix A - List of Unit Prices.

6. SUBCONTRACTOR LISTING

	Subcontractor	License No.
A. Plumbing		
B. Mechanical		

C. Electrical

D. Roofing

7. TRENCHING SAFETY SYSTEM

Ark. Code Ann. § 22-9-212 requires the contractor to indicate on this Bid Form the cost of Trenching Safety Systems. ***FAILURE TO SHOW THIS COST WILL INVALIDATE THE BID.*** (NOTE THIS COST SHALL BE INCLUDED IN THE ABOVE BASE BID)

.....
(Dollar Amount Is To Be Shown Numerically)

8. BID FORM SIGNATURES

.....
(Bidder - print the full name of your firm)

.....
(Authorized signing officer)

.....
(License Number)

END OF DOCUMENT

BID FORM SUPPLEMENTS

To: First Community Bank
Mr. Dale Cole

Project: A New Facility for
First Community Bank
Hwy. 62/412 and Big Creek Road
Jonesboro, AR

Date:

Submitted by:
(full name and address)

In accordance with Document 00 21 13 and Document 00 41 13, we include the Appendices to Bid Form Supplements listed below. The information provided shall be considered an integral part of the Bid Form.

The following Appendices are attached to this document:

Appendix A - List of Unit Prices: Include listing of unit prices specifically requested by Contract Documents.

BID FORM SUPPLEMENTS SIGNATURES

.....
(Bidder - print the full name of your firm)

.....
(Authorized signing officer)

.....
(License Number)

APPENDIX A - LIST OF UNIT PRICES

The following is the list of unit prices referenced in the bid submitted by:

(Bidder)

To (Owner) First Community Bank, Mr. Dale Cole

Dated and which is an integral part of the Bid Form.

The following are Unit Prices for specific portions of the Work as listed, and are applicable to authorized variations from the Contract Documents.

ITEM DESCRIPTION	UNIT	UNIT VALUE
1. Removal and replacement of unstable soil, compacted in place.	Cu. Yd.	

END OF DOCUMENT

GENERAL CONDITIONS

1.1 SUMMARY

- A. Document Includes: General Conditions.
- B. Related Documents:
 - 1. Document 00 73 13 - Supplementary Conditions.

1.2 GENERAL CONDITIONS

- A. AIA Document A201-2017, General Conditions of the Contract for Construction, is the General Conditions of the Contract. They are hereby incorporated into and made as much a part of this Project Manual as if bound herein. A copy of the General Conditions is on file and may be examined in the Architect's office. The printed General Conditions will be bound in each of the contract copies of the Project Manual to be retained by the Owner, Architect, and Contractor as part of the executed Contract Documents.

1.3 SUPPLEMENTARY CONDITIONS

- A. Refer to Document 00 73 13 for modifications to General Conditions.

END OF DOCUMENT

SUPPLEMENTARY CONDITIONS

1.1 SUMMARY

- A. Document Includes: Supplementary Conditions.
- B. Related Documents:
 - 1. Document 00 72 14 - General Conditions.

1.2 SUPPLEMENTARY CONDITIONS

- A. These Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201-2017, and other provisions of the Contract Documents as indicated below. All provisions which are not so modified remain in full force and effect.
- B. The terms used in these Supplementary Conditions which are defined in the General Conditions of the Contract for Construction, AIA Document A201-2017, have the meanings assigned to them in the General Conditions.

ARTICLE 1.1 - BASIC DEFINITIONS

Delete subparagraph 1.2.1 and substitute the following:

"1.2.1 The Architect shall identify those Contract Documents which are a part of the Agreement."

ARTICLE 3 - CONTRACTOR

Add subparagraph 3.4.4 under paragraph 3.4 as follows:

"3.4.4 All contractors and subcontractors engaged in the Owner/Contractor Agreement shall conform to the labor laws of the State of Arkansas and the various acts amendatory and supplementary thereto; and to all other laws, ordinances and legal requirements applicable thereto."

Add the following to the end of paragraph 3.5 as follows:

"The Contractor shall guarantee and warrant his and his subcontractors' work and materials (including the materials and work of suppliers of the Contractor and his subcontractors) for a period of one year from the date of acceptance of the project by the Owner. This warranty shall be for a longer period on certain items if so designated in the specifications. The foregoing one-year guaranty and warranty shall not in any way limit, restrict or affect the liability of the Contractor, or his subcontractors, for indemnity as provided for in this Contract, nor shall it in any way shorten the period of limitation fixed by law for the filing of any action against the Contractor for enforcement or for breach of any provisions of the Contract Documents. Should the Contractor elect to use any of the equipment in the building during the construction period,

he shall make arrangements with the subcontractor or supplier of the equipment for any extension of warranty of that equipment made necessary by such use. The warranty period for such equipment to the Owner shall not be reduced by the use of equipment by the Contractor."

Add the following sentence to subparagraph 3.7.1:

"Specifically including the Occupancy Permit."

Add the following sentence to subparagraph 3.9.3:

"The Contractor shall, at all times, enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the Work assigned to him."

ARTICLE 5 - SUBCONTRACTORS

Add subparagraph 5.2.5 under paragraph 5.2 as follows:

"5.2.5 Where any of the provisions of this paragraph 5.2 conflict with laws of the State of Arkansas, as amended, the provisions of such laws and amendments thereto shall govern."

ARTICLE 7 - CHANGES IN THE WORK

Delete subparagraph 7.3 and substitute the following new paragraph 7.1.4 in lieu thereof:

- "7.1.4 The method used in determining adjustments in the contract sum shall be as follows:
1. Without invalidating the Contract, the Owner may order extra Work or make changes by altering, adding to or deducting from the Work, the contract sum being adjusted accordingly, and with the Contractor obtaining the consent of the surety where necessary or desirable.
 2. No claims for any extra Work or materials shall be allowed unless the Work is ordered in writing by the Architect.
 3. Any changes in the Work will be on a basis of actual cost plus 12% of the cost for overhead and profit, including insurance, for the Contractor performing the Work (subcontractor or General Contractor).
 4. If changes in the Work are performed by a subcontractor, the value of any such Work shall be computed as outlined in subparagraph 3 above, to which the General Contractor may add an overhead and profit charge of six percent (6%), including insurance.
 5. Work omitted that was included in the original Contract shall be computed on the same basis.
 6. The Contractor shall furnish an itemized breakdown for the requested change in Work.
 7. Bills for extras will be allowed only when Work is ordered in writing. No bills based on verbal orders will be allowed unless accompanied by a written order from the Owner.
 8. The Contractor waives all claims for extension of time of completion on account of extra Work, unless application for such extension of time is made by the Contractor in writing within 24 hours of the time such Work is ordered."

ARTICLE 9 - PAYMENTS AND COMPLETION

Delete paragraph 9.3 in its entirety and substitute the following paragraph 9.3 in lieu thereof:

"9.3 APPLICATIONS FOR PAYMENT

- 9.3.1 The Contractor shall present to the Architect an application for payment on or before the twenty-fifth day of each calendar month. These periodical estimates for partial payment shall be submitted on AIA Document G702 and G703.

In preparing estimates, the material delivered and suitably stored on the site and preparatory Work done may be taken into consideration. The Architect shall review the applications for payment in accordance with the general observations of the Work and the percentage of completion of each category before submitting them to the Owner for payment. No later than the 10th day of each calendar month, the Owner will make partial payment to the Contractor, but the Owner will retain 10% of the amount of each such estimate. There shall be retained 10% on the estimated amounts until final completion and acceptance of all Work covered by the Contract. Before issuance of the final certificate, the Contractor shall obtain in writing from the bonding company, approval of such payment. No certificate issued nor payment made to the Contractor, nor partial or entire use or occupancy of the Contract Work by the Owner, shall be an acceptance of any Work or materials not in accordance with this Contract.

- 9.3.2 If approved in advance by the Owner, payment may similarly be made for materials and equipment suitable 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 applicable insurance, storage and transportation to the site for such materials and equipment stored off the site."

ARTICLE 11 - INSURANCE AND BONDS

Delete paragraphs 11.1, 11.2, 11.3, and 11.4, and substitute the new paragraphs 11.1, 11.2, 11.3, and 11.4 as follows:

"11.1 GENERAL

- 11.1.1 The Contractor shall not commence Work under this Contract or allow any subcontractor or anyone directly or indirectly employed by anyone of them, to commence Work until he has obtained all insurance required under this section and duly executed certificates of such insurance have been filed with the Architect and approved by the Owner. All insurance policies, certificates and endorsements shall be submitted to the Architect in duplicate; one copy of which will be retained by the Architect and the other forwarded to the Owner. The Contractor shall require all subcontractors or anyone directly or indirectly

employed by any of them, and anyone for whose acts any of them may be liable, to either obtain statutory Workmen's Compensation, Comprehensive General Liability and Comprehensive Automobile Insurance coverage for his (the subcontractor's) portion of the Work or reimburse the Contractor for providing such insurance coverage. Comprehensive General Liability insurance and Comprehensive Automobile Liability insurance shall protect the Contractor from claims for bodily injury including death to his employees, or of any person other than his employees, and all other claims for property damage including water damage legal liability, personal injury liability, damage from collapse, damage from grading, excavation and all underground work, any and all of which may arise out of or result from the Contractor's operations required for the project, whether such operations be by himself or by any subcontractor or anyone directly employed by either of them.

11.1.2 The required insurance must be written by a company licensed to do business in the State of Arkansas, at the time of the policy issue. In addition, the companies must be acceptable to the Owner.

11.1.3 The Contractor shall not cause any insurance to be canceled nor permit any insurance to lapse. All insurance policies shall contain a clause to the effect that the policy shall not be cancelled or reduced, restricted or limited until fifteen days after the Owner and Architect have received written notice. Certificates of insurance shall contain transcripts from the proper office of the insurer, evidencing in particular, those insured, the extent of the insurance, the location, and the operations to which the insurance applies, the expiration date, and the above mentioned notice of cancellation clause.

11.2 WORKMEN'S COMPENSATION INSURANCE

11.2.1 The Contractor shall procure and maintain during the term of the Contract, Workmen's Compensation Insurance for all his employees engaged at the site of the Work, in accordance with the statutes of the State of Arkansas. In case any hazardous occupations are required for the execution of the Work, which are not covered by the above insurance, special Employer's Liability policy shall be procured and maintained during the term of the Contract by the Contractor to cover workmen engaged in such hazardous occupations.

11.3 LIABILITY AND PROPERTY INSURANCE

11.3.1 Comprehensive General Liability Insurance - The Contractor shall procure and maintain during the term of this Contract, at the Contractor's expense, a comprehensive general liability policy including products/completed operations with limits no less than \$1,000,000 combined single limit or \$500,000 each occurrence and \$1,000,000 aggregate for bodily injury and \$500,000 each occurrence and \$500,000 aggregate for property damage. Contractor shall also furnish umbrella limits of \$1,000,000.

This policy must include "Contractual Coverage" to cover contractual indemnity, and hold harmless the Owner and Architect and all their agents and employees from and against all claims, damages, losses, and expenses, including attorney's fees arising out of or resulting from the performance of the Work, provided such

claim, damage, loss, injury, sickness, disease, death or injury to or destruction of tangible property other than the Work itself, including the loss of use resulting therefrom, and is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a part indemnified thereunder. Provide an endorsement to the policy to include the Architect as additional insured.

11.3.2 Comprehensive Automobile Liability Insurance - The Contractor shall procure and maintain during the term of the contract, at the Contractor's expense, comprehensive automobile liability limits not less than \$1,000,000 combined single limit or \$500,000 per person and \$500,000 per accident for bodily injury and \$500,000 limit per accident for property damage. Umbrella liability limits may be used to certify the limits. Provide an endorsement to the policy to include the Architect as additional insured.

11.3.3 Builder's Risk Insurance - The Contractor shall take out and maintain during the life of the Contract and until same has been accepted, Builder's Risk, Fire Extended Coverage, Vandalism, and Malicious Mischief Insurance for an amount equal to 100% of the total value of the Contract sum of the Work. Said insurance coverage to be written in the name of the Contractor and Owner. This insurance shall not be cancelled or reduced upon Substantial Completion of the Project, but shall be kept in force until final acceptance of the Project and final payment is made.

11.4 PERFORMANCE AND PAYMENT BOND

11.4.1 Furnish a Performance and Payment Bond in the amount equal to 100% of the Contract Price, as security for the faithful performance of this Contract and for payment of all indebtedness for labor and materials furnished in connection with this Contract. The bond shall be written by a surety company which has qualified and is authorized to do business in the State of Arkansas and must be executed by a resident local agent who shall be entitled to full commission paid local agents and who is licensed by the Insurance Commissioner to represent the surety company executing said bond and filing with said bond, his power of attorney as his authority. The mere countersigning of a bond will not be sufficient. The bond shall be written in favor of the Owner.

11.4.2 An original and two copies of the bond must be furnished, with power of attorney attached to each. The bond must not be dated prior to the date of the Contract. The Contractor shall file (not record) the original with the Clerk of the Circuit Court of the County in which the Work to be performed is located. The Contractor is to pay all expenses incident to the filing of the bond. The remaining two copies should be certified by the Clerk to evidence the filing of the original and these two copies submitted to the Architect."

ARTICLE 13 - MISCELLANEOUS PROVISIONS

Add paragraph 13.6, "SUBSTITUTIONS", as follows:

"13.6 SUBSTITUTIONS

- 13.6.1 Where a definite material is specified, it is not the intent to discriminate against any equal product of another manufacturer. It is the intent to set a definite standard. Open competition is expected, but in all cases, complete data must be submitted on all proposed substitutes and samples shall be submitted for comparison and test when requested by the Architect. No substitution shall be made unless authorized in writing by the Architect. If the Contractor intends to substitute an equal product, he shall make this fact known, in writing, to the Architect within 30 days after the award of the Contract, including any changes in the Work required to accommodate the substitution.
- 13.6.2 Should a substitution be accepted and should the substitute material prove defective or otherwise unsatisfactory for the service intended and within the guaranty period, the Contractor shall replace this material or equipment with the material or equipment specified by name.
- 13.6.3 After execution of the Contract Agreement, proposed substitutions will be considered only if there is no decrease in quality, and only when submitted by or through the General Contractor. Such requests shall be submitted promptly in order to allow adequate time for checking and study by the Owner and Architect without delaying the project. Requests for time extensions will not be approved for delays due to related substitutions. No substitution will be allowed without the Architect's approval, in writing.

ARTICLE 15 - CLAIMS AND DISPUTES

In subparagraph 15.4.1, after the words, "American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the agreement", add the words, "subject to applicable laws of the state of Arkansas".

END OF DOCUMENT

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract description.
- B. Work by Owner.
- C. Owner supplied products.

1.2 CONTRACT DESCRIPTION

- A. Work Covered by Contract Documents: Architect's Project #1711, dated December 7, 2022 includes furnishing tools, labor and equipment to perform the work required for the new facility for First Community Bank, located at Hwy. 62/412 and Big Creek Road in Jonesboro, AR including civil, landscaping, general construction, mechanical and electrical work in accordance with the following:
 - 1. Conditions of Contract: General Conditions, Supplementary Conditions
 - 2. Specifications: Divisions 0, 1, 3 through 12, 14, 21, 22, 23, 26, 27, 28, 31, 32, and 33
 - 3. Drawings:
 - a. Cover Sheet
 - b. General Information Sheet Nos. G1.0, G1.1, G1.2, G1.3
 - c. Civil Sheet Nos. C1.1, C1.2, C1.3, C1.4, C1.5, C2.1, C5.1, C5.2, C5.3
 - d. Landscape Sheet Nos. L1.1, LI1.1, LI5.1
 - e. Architectural Sheet Nos. A1.0, A1.1, A1.2, A2.1, A2.2, A3.1, A4.1, A4.2, A4.3, A4.4, A4.5, A4.6, A5.1, A5.2, A5.3, A5.4, A6.1, A6.2, A7.1, A7.2, A8.1, A9.1, A9.2, A10.1, A10.2
 - f. Structural Sheet Nos. S1.1, S1.2, S2.1, S3.1, S3.2, S4.1, S4.2, S4.3, S4.4, S5.1, S5.2, S5.3, S5.4
 - g. Mechanical Sheet Nos. M0.1, M1.1, M1.2, M1.3, M2.1, M2.2, M2.3, M3.1, M4.1
 - h. Plumbing Sheet Nos. P0.1, P1.1, P1.2, P1.3, P2.1, P2.2, P2.3, P3.1, P3.2, P4.1, P5.1
 - i. Electrical Sheet Nos. E1.01, E2.01, E2.02, E3.01, E3.02, E3.03, E3.04, E3.05, E4.01, E4.02
 - 4. Addenda: Any addenda issued during the bidding period and made a part of the Contract Documents.
 - 5. Agreements: Contract Agreement between Owner and Contractor as executed, and mutually agreed upon Bid Modification Documents and change orders issued.

1.3 WORK BY OWNER

- A. Items noted NIC (Not in Contract), will be furnished and installed by Owner beginning Substantial Completion.

- B. Schedule:
 - 1. Furnishings
 - 2. Equipment
 - 3. Data, telecommunications, cable TV, A/V
 - 4. Low voltage cabling
 - 5. Bank equipment
 - 6. Soap dispensers

1.4 OWNER FURNISHED CONTRACTOR INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
 - 2. Arrange and pay for delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.
- C. Items furnished by Owner for installation by Contractor:

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cash allowances.
- B. Schedule of values.
- C. Applications for payment.
- D. Change procedures.
- E. Unit prices.

1.2 CASH ALLOWANCES

- A. Costs Included in Cash Allowances: Cost of product to Contractor, less applicable trade discounts; delivery to site and applicable taxes.
- B. Costs Not Included in Cash Allowances but Included in Contract Sum/Price: Product handling at site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.
- C. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order.
- D. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of selection by Architect, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- E. Differences in costs will be adjusted by Change Order.
- F. Allowances Schedule:
 - 1. Provide an allowance of 2,5000 cubic yards for removal and replacement of unsuitable soil. Soil to be compacted and minimum 95 percent maximum Modified Proctor dry density (ASTM D 1557) as required by soils engineer.
 - 2. Provide an allowance for cutting in 20 grommets in countertops. (This includes ALL types of countertops.)

1.3 SCHEDULE OF VALUES

- A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.
- B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
- C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section.
- D. Include in each line item, amount of Allowances specified in this section.
- E. Include separately from each line item, direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702. Submit electronically.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Submit updated construction schedule with each Application for Payment.
- D. Payment Period: Monthly, as stated in the Supplementary Conditions.
- E. Substantiating Data: When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.5 CHANGE PROCEDURES

- A. The Architect will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing a Drawing Clarification.
- B. The Architect may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. Contractor will prepare and submit estimate within 10 days.
- C. Contractor may propose changes by submitting a request for change to Architect, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors.
- D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Architect.
- E. Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect will

determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

- F. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- H. Correlation of Contractor Submittals:
 - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
 - 2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
 - 3. Promptly enter changes in Project Record Documents.

1.6 UNIT PRICES

- A. Unit Quantities: Quantities and measurements indicated in Bid Form are for contract purposes only. Actual quantities provided shall determine payment.
- B. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.
- C. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Architect multiplied by unit sum/price for Work incorporated in or made necessary by the Work.
- D. Unit Price Schedule:
 - 1. Removal and replacement of unstable soil, compacted in place. Price to be per cubic yard.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Field engineering.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Pre-installation meetings.
- F. Cutting and patching.
- G. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion, and for portions of Work designated for Owner's partial occupancy.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

- A. Employ Land Surveyor registered at Project location and acceptable to Architect.
- B. Locate and protect survey control and reference points. Promptly notify Architect of discrepancies discovered.
- C. Verify set-backs and easements; confirm drawing dimensions and elevations.
- D. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- E. Maintain complete and accurate log of control and survey work as Work progresses.
- F. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- G. Promptly report to Architect loss or destruction of reference point or relocation required because of changes in grades or other reasons.
- H. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

1.4 PRECONSTRUCTION MEETING

- A. Architect will schedule meeting after Notice to Proceed.
- B. Attendance Required: Owner, Architect, major subcontractors, Superintendent, and Contractor.
- C. Agenda:
 - 1. Bonds and insurance.
 - 2. Documents
 - 3. List of subcontractors.
 - 4. Construction schedule.
 - 5. Designation of personnel represented for contact on this job.
 - 6. Procedure for processing field decisions as they relate to proposal requests and finally change orders.
 - a. RFI's, PR's and Change Orders.
 - b. Design questions.
 - 7. Scheduling and reports of geotech.
 - 8. Visits by Owner and contractor to project site.
 - 9. Temporary utilities provided by the Owner.
 - 10. Survey and building layout.
 - 11. Security on site.
 - 12. Application of payment document preference, date, etc.
 - 13. Special Inspections.
 - 14. As built drawings schedule.
 - 15. Protection of in-place equipment and use of before end of construction.
 - 16. Owner furnished items – coordination and installation.
- D. Record minutes and distribute copies within two days after meeting to participants, and those affected by decisions made.

1.5 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems impeding planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, and those affected by decisions made.

1.6 PRE-INSTALLATION MEETINGS

- A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Architect/Engineer one week in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with one copy to Architect/Engineer, and those affected by decisions made.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.
- F. Restore Work with new products in accordance with requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to Architect for decision or remedy.

3.2 SPECIAL PROCEDURES

- A. Remove debris from area and from concealed spaces.
- B. Prepare surface and remove surface finishes to permit installation of new work and finishes.

- C. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- D. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing smooth transition; to Architect for review
- E. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Product data.
- E. Shop drawings.
- F. Samples.
- G. Design data.
- H. Test reports.
- I. Certificates.
- J. Manufacturer's instructions.
- K. Manufacturer's field reports.
- L. Construction photographs.

1.2 SUBMITTAL PROCEDURES

- A. Transmit each submittal with AIA Form G810.
- B. Send submittals electronically. Do not submit MSDS sheets or any unnecessary data. Clearly mark products proposed for use. In addition to electronic submittals for structural, send one hard copy.
- C. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- D. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- F. Schedule submittals to expedite Project, and deliver to Architect. Coordinate submission of related items.

- G. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- H. Submittals may require more than one submission. However, submittals not reviewed by the General Contractor, which require more than one resubmittal, will result in charges levied for time spent reviewing repeated submittals. Charges will be billed to the General Contractor and arrangements must be made for payment before the submittals will be returned. Such unnecessary extensions of time cannot be used to extend the contract time.
- I. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- J. Allow space on submittals for Contractor and Architect/Engineer review stamps.
- K. When revised for resubmission, identify changes made since previous submission. The complete submittal will not be reviewed again, only the items marked. Architect/Engineer will not be responsible for any other changes to previously accepted items.
- L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedules within 15 days after date of Owner-Contractor Agreement.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
- D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- E. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, = identifying first work day of each week.
- F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
- G. Indicate estimated percentage of completion for each item of Work at each submission.
- H. Submit separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- I. Indicate delivery dates for Owner furnished products.
- J. Revisions to Schedules:

1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate contractors.

1.4 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit electronically.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.6 SHOP DRAWINGS

- A. Any drawings provided by the Architect or Engineer to be used in the preparation of shop drawings will be at the cost of \$100 per sheet.
- B. Shop Drawings: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 1. Include signed and sealed calculations to support design.

2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- E. Submit one hard copy structural submittals that include drawings. All other submittals may be submitted electronically.
- F. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.7 SAMPLES

- A. Samples: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples For Selection as Specified in Product Sections:
1. Submit to Architect for aesthetic, color, or finish selection.
 2. Submit samples of finishes in colors selected.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Architect will retain one sample.
- F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00 - Execution and Closeout Requirements.

1.8 DESIGN DATA

- A. Submit for Architect's knowledge as contract administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

- A. Submit for Architect's knowledge as contract administrator or for Owner.

- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect/Engineer's benefit as contract administrator or for Owner.
- B. Submit report within 5 days of observation to Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 CONSTRUCTION PHOTOGRAPHS

- A. Provide photographs of site and construction throughout progress of Work.
- B. Twice monthly submit photographs with Application for Payment.
- C. Identify each print on back. Identify name of Project, orientation of view, date and time of view.
- D. Deliver negatives to Owner with project record documents. Catalog and index negatives in chronological sequence; include typed table of contents.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Superintendent.
- B. Quality control and control of installation.
- C. Tolerances.
- D. References.
- E. Labeling.
- F. Mock-up requirements.
- G. Testing and inspection services.
- H. Manufacturers' field services.
- I. Examination.
- J. Preparation.

1.2 SUPERINTENDENT

- A. The Superintendent assigned to this project must be competent and satisfactory to the Architect.
- B. Do not change superintendents except with the consent of the Architect, unless he proves to be unsatisfactory, or ceases to be in his employ.

1.3 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.

- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.6 LABELING

- A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.7 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

- C. Accepted mock-ups shall be comparison standard for remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.8 TESTING AND INSPECTION SERVICES

- A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
 - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.
- B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect.
 - 1. Laboratory: Authorized to operate at Project location.
 - 2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Architect or Owner. Refer also to Section 01 40 10 for Special Inspections.
- D. Reports will be submitted by independent firm to Architect and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
 - 1. Submit final report indicating correction of Work previously reported as non-compliant.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Architect and independent firm 2 weeks prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect/Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- H. Agency Responsibilities:

1. Test samples of mixes submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 6. Perform additional tests required by Architect.
 7. Attend preconstruction meetings and progress meetings.
- I. Agency Reports: After each test, promptly submit four copies of report to Architect, Contractor, and authority having jurisdiction. When requested by Architect, provide interpretation of test results. Include the following:
1. Date issued.
 2. Project title and number.
 3. Name of inspector.
 4. Date and time of sampling or inspection.
 5. Identification of product and specifications section.
 6. Location in Project.
 7. Type of inspection or test.
 8. Date of test.
 9. Results of tests.
 10. Conformance with Contract Documents.
- J. Limits on Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency or laboratory may not approve or accept any portion of the Work.
 3. Agency or laboratory may not assume duties of Contractor.
 4. Agency or laboratory has no authority to stop the Work.

1.9 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 2 weeks in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 33 00 - Submittal Procedures, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.
- D. Beginning of Work constitutes acceptance of substrate and conditions.

END OF SECTION

SPECIAL INSPECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Special Inspection is the monitoring of the materials and workmanship critical to the integrity of the building structure. It is a review of the work of the contractors and their employees to ensure that the approved plans and specifications are being followed and that the relevant codes and referenced standards are being observed. The Special Inspection process is *in addition* to the inspections conducted by the Building Official or authority having jurisdiction, Structural Observation by the Design Professional and any other test or inspections required by the Construction Documents.
- B. Refer to the Statement of Special Inspections at the end of this Section, as well as the Schedule of Special Inspection Services.
- C. Special inspections and tests are required to be performed by qualified, independent agents with special expertise as approved by the Building Official.
- D. Special Inspections per Building Code Section 1704 are required to be provided on all professionally designed projects not meeting the exceptions described in Section 1704.2 or as determined by the Building Official.

1.2 SUBMITTALS

- A. Submit a *Statement of Special Inspections*, including a *Schedule of Special Inspection Services* prepared by the Registered Design Professional in Responsible Charge, to the Building Official at time of permit application, as part of the general requirements Section 1704 of the Building Code, Special Inspections.
- B. Include the following, in accordance with Section 1704.3 of the Building Code:
 - 1. *Schedule of Special Inspection Services*, containing the following items:
 - a. The materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work.
 - b. The type and extent of each special inspection.
 - c. The type and extent of each test.
 - d. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Section 1705.10, 1705.11 and 1705.12.
 - e. For each type of special inspection, identification as to whether it will be continuous special inspection or periodic special inspection.
 - 2. Additional special inspection and testing requirements for seismic resistance where required by Building Code Sections 1705.10, 1705.11 or 1705.12.

- a. Submit a written statement of responsibility to the building official and Design Professional in Responsible Charge prior to the commencement of work on the system or component. This is required for each contractor responsible for the construction of a seismic resistant system or component listed in the *Statement of Special Inspections*.
- C. Maintain the *Schedule of Special Inspection Services* during the course of the construction project and reflect any changes.
- D. At the completion of work and prior to the issuing the Certificate of Occupancy, submit a *Final Report of Special Inspections* in accordance with *Building Code* Section 1704.2.4 to the Building Official. This report shall document the completion of all required special inspections and testing.

1.3 SPECIAL INSPECTION RESPONSIBILITIES

- A. Special Inspectors Responsibilities:
 - 1. Notify the contractor of their presence and responsibilities at the job site.
 - 2. Observe assigned work for which they are responsible for conformance with the plans and specifications.
 - 3. Report nonconforming items to the immediate attention of the contractor for correction.
 - 4. Write a discrepancy notice about each nonconforming item containing:
 - a. Description and exact location.
 - b. Reference to applicable drawings and specifications.
 - c. Resolution or corrective action taken and the date.
 - 5. Provide timely reports and furnish these reports directly to the Design Professional and the contractor.
 - a. Describe the special inspection and tests made, with locations.
 - b. Indicate nonconforming items and their resolution.
 - c. List unresolved items and parties notified.
 - d. Itemize any changes authorized by the Design Professional.
 - 6. Furnish interim reports to the Building Official and Design Professional at the frequency indicated on the *Statement of Special Inspections*.
 - 7. Initial and date the "Date Completed" box in the *Schedule of Special Inspection Services* as the inspection and testing activities are completed.
 - 8. Submit a signed *Final Report of Special Inspections* stating that all required special inspections and testing were fulfilled and reported and that any outstanding discrepancies have been corrected.
- B. Contractor Responsibilities:
 - 1. Engage the Special Inspector(s).
 - 2. Submit to the Building Official a list of the individuals, approved agencies or firms intended to be retained for conducting special inspections.
 - 3. Submit all *Statement(s) of Responsibility* (pg C1) where required by the *Statement of Special Inspections*.
 - 4. Maintain the *Schedule of Special Inspection Services* at the project site and submit a copy to the Design Professional and the Building Official when all the services are complete.
 - 5. Notify the Special Inspector(s) when special inspections are needed.
 - 6. Coordinate the scheduling and timely notification of the specific individuals needed for the Special Inspection.

7. Provide direct access to the approved design drawings and specifications for the project, as well as any revisions.
8. Provide safe access to the work to be inspected.
9. Maintain at the project site for use by the Special Inspectors at least one copy of:
 - a. All required manufacturer's equipment Certificates of Compliance.
 - b. All shop drawings/submittals indicating seismic restraint design for all designated seismic systems.
10. Remedy deficient work as construction progresses and prior to final inspection.
11. Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.2 of the *Building Code* must submit *Fabricator's Certificate of Compliance* at the completion of fabrication to the contractor.
12. Remedy deficient work as construction progresses and prior to final inspection.

1.4 FORMS

- A. The following forms are included at the end of this section for use in meeting these requirements.
 1. Statement of Special Inspections
 2. Schedule of Special Inspection Services
 3. Contractor's Statement of Responsibility
 4. Special Inspection Report
 5. Special Inspection Discrepancy Notice
 6. Fabricator's Certificate of Compliance
 7. Statement of Special Inspections for Seismic Resistance
 8. Final Report of Special Inspections: Submit when all the special inspection requirements for a project have been fulfilled and all noted deficiencies have been corrected. Each special inspector corresponding to an agent number in the *Schedule of Special Inspection Services* will be required to complete a copy of this form for submittal to the Design Professional and the Building Official for their scope of work. The special inspection program will not be considered complete until forms from all agents have been submitted and received.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

STATEMENT OF SPECIAL INSPECTIONS

(Completed by the Registered Design Professional in Responsible Charge)

PROJECT: New Facility for First Community Bank

LOCATION: Hwy. 62/412 and Big Creek Road, Jonesboro, AR

PERMIT APPLICANT:

APPLICANT'S ADDRESS:

ARCHITECT OF RECORD: Timothy S. Yelvington, AIA

STRUCTURAL ENGINEER OF RECORD: Robert E. Gatlin

MECHANICAL ENGINEER OF RECORD: James S. Chidester, PE

ELECTRICAL ENGINEER OF RECORD: Robert D. Merriott, PE

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: David W. Perry, AIA

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2012 Arkansas Fire Prevention Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Requirements for Seismic Resistance* and/or *Requirements for Tornado Resistance*.

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*?

☒ Yes ☐ No

Are *Requirements for Tornado Resistance* included in the *Statement of Special Inspections*?

☐ Yes ☒ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

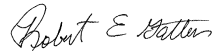
Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

☐ Weekly ☐ Bi-Weekly ☒ Monthly Other; specify: _____

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

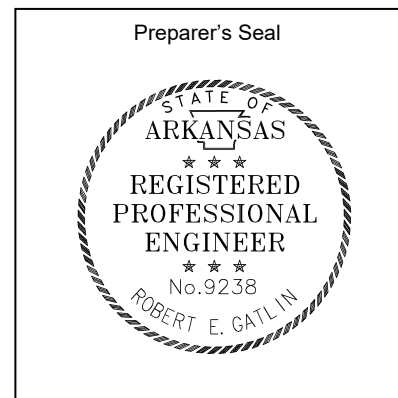
Robert E. Gatlin
Type or print name

 6-22-2022
Signature Date

Building Official's Acceptance:

Signature Date

Permit Number:



Frequency of interim report submittals to the Building Official:

☐ Monthly ☐ Bi-Monthly ☒ Upon Completion Other; specify: _____

Statement of Special Inspections Requirements for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements.

Seismic Design Category: D

Statement of Special Inspection for Seismic Resistance Required (Yes/No): YES

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:

(Required for Seismic Design Categories C, D, E or F in accordance with Building Code Section 1705.11.1 through 1705.11.3, 1705.12.1 and 1705.12.2.)

Intermediate Steel Moment Frames

Description of designated seismic systems subject to special inspection, testing and qualification for seismic resistance:

(Required for architectural, electrical and mechanical systems and their components that require design in accordance with ASCE 7-10 Chapter 13, have a component importance factor, I_p , greater than one and are in Seismic Design Categories C, D, E or F, in accordance with Building Code Section 1705.11.4 and 1705.12.3.)

Description of additional components and systems requiring special inspections, testing and qualification for seismic resistance:

(Required for systems noted in Building Code Section 1705.11, cases 3, 4 & 5 or Section 1705.12, cases 3 & 4, in Seismic Design Category C,D,E or F)

Statement of Responsibility:

Each contractor responsible for the construction or fabrication of a system or component described above must each submit a Statement of Responsibility (pg C1) in accordance with Building Code Section 1704.4.

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1704.2.5 Inspection of Fabricators					
Verify fabrication/quality control procedures.	In-plant review (3)	Y	Periodic		
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative construction materials, unusual design applications, systems or materials with special manufacturer requirements. Attach 8 1/2x11 if needed).	Submittal review, shop(3) inspection and/or field inspection.	N			
1705.2 Structural Steel Construction					
1. Review the material test reports and certificates as listed in AISC 360-10, Section N3.2 for compliance with the construction documents	Submittal review	Y	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	Y	Periodic		
3. Anchor Rods and other Embedment(s) (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Continuous		
4. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: <i>see Commentary</i>					
1) Complete penetration groove welds at joints in materials 5/16" thick or greater in Risk Category III or IV	Shop (3) or field ultrasonic testing - 100%	N	Periodic		
2) Complete penetration groove welds at joints in materials 5/16" or greater in Risk Category II	Shop (3) or field ultrasonic testing - 100% of welds minimum	Y	Periodic		
3) Thermally cut surfaces of access holes when material $t > 2"$	Shop (3) or field magnetic Particle or Penetrant testing	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	Y	Periodic		
5) Fabricator's NDT reports when fabricator performs NDT	Verify reports	Y	Each submittal (5)		
6. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360-10, Table N5.6-1)		Y	Observe or Perform as noted (4)		
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360-10, Table N5.6-2)		Y	Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		Y	Continuous		
e) Calibrated wrench		Y	Continuous		
2) Snug-tight joints		Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)		
7. Inspection of steel elements of composite construction prior to concrete placement in accordance with QA tasks listed in AISC 360-10, Table N6.1 and Section N6	Shop (3) and field inspection and testing		Observe or Perform as noted (4)		
a. Placement and installation of steel deck		Y	Periodic		
b. Placement and installation of steel headed stud anchors		Y	Periodic		
1705.2.2 Steel Construction Other Than Structural Steel					
1. Material verification of cold-formed steel deck:					
a. Identification markings	Field inspection	Y	Periodic		
b. Manufacturer's certified test reports	Submittal Review	Y	Each submittal		
2. Connection of cold-formed steel deck to supporting structure:	Shop (3) and field inspection				
a. Welding		Y	Periodic		
b. Other fasteners (in accordance with AISC 360, Section N6)					
1) Verify fasteners are in conformance with approved submittal		Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2) Verify fastener installation is in conformance with approved submittal and manufacturer's recommendations		Y	Periodic		
3. Welding reinforcing steel	Shop (3) and field inspection				
a. Verification of weldability of steel other than ASTM A706		N	Periodic		
b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, boundary elements of special concrete structural walls and shear reinforcement		N	Continuous		
c. Shear reinforcement		N	Continuous		
d. Other reinforcing steel		N	Periodic		
4. Cold-formed steel trusses spanning 60 feet or greater					
a. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.3 Concrete Construction					
1. Inspection of reinforcing steel placement	Field inspection	Y	Periodic		
2. Inspection of prestressing steel placement	In-plant or field review	N	Periodic		
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used	Shop (3) and field inspection	Y	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete: Per research reports requirements	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6. Fresh concrete sampling, perform slump and air content tests and determine temperature of concrete	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	Y	Continuous		
8. Inspection for maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:	In-plant or field review				
a. Application of prestressing forces		N	Continuous		
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system		N	Continuous		
10. Erection of precast concrete members					
a. Inspect in accordance with construction documents	Field inspection	Y	Periodic		
b. Perform inspections of welding and bolting in accordance with Section 1705.2	Field inspection	Y	In accordance with Section 1705.2		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	Field testing and review of laboratory reports	Y	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic		
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
1705.4 Masonry Construction					
(A) Level A, B and C Quality Assurance:					
1. Verify compliance with approved submittals	Field Inspection	N	Periodic		
(B) Level B Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction	Testing by unit strength method or prism test method	N	Periodic		
(C) Level C Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction and for every 5,000 SF during construction	Testing by unit strength method or prism test method	N	Periodic		
2. Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than selfconsolidating grout, as delivered to the project site	Field inspection	N	Continuous		
3. Verify placement of masonry units	Field Inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
(D) Levels B and C Quality Assurance:					
1. Verification of Slump Flow and Visual Stability Index (VSI) of selfconsolidating grout as delivered to the project	Field testing	N	Continuous		
2. Verify compliance with approved submittals	Field inspection	N	Periodic		
3. Verify proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	Field Inspection	N	Periodic		
4. Verify grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	N	Periodic		
5. Verify construction of mortar joints	Field Inspection	N	Periodic		
6. Verify placement of reinforcement, connectors, and prestressing tendons and anchorages	Field Inspection	N	Level B - Periodic		
		N	Level C - Continuous		
7. Verify grout space prior to grouting	Field Inspection	N	Level B - Periodic		
		N	Level C - Continuous		
8. Verify placement of grout and prestressing grout for bonded tendons	Field Inspection	N	Continuous		
9. Verify size and location of structural masonry elements	Field Inspection	N	Periodic		
10. Verify type, size, and location of anchors, including details of anchorage of masonry to structural members, frames, or other construction.	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
11. Verify welding of reinforcement (see 1705.2.2)	Field inspection	N	Continuous		
12. Verify preparation, construction, and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F)	Field inspection	N	Periodic		
13. Verify application and measurement of prestressing force	Field Inspection	N	Continuous		
14. Verify placement of AAC masonry units and construction of thin-bed mortar joints (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
15. Verify placement of AAC masonry units and construction of thin-bed mortar joints (after the first 5000 SF of AAC masonry)	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
16. Verify properties of thin-bed mortar for AAC masonry (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
17. Verify properties of thin-bed mortar for AAC masonry (after the first 5000 SF of AAC masonry)	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
18. Prepare grout and mortar specimens	Field testing	N	Level B - Periodic		
		N	Level C - Continuous		
19. Observe preparation of prisms	Field inspection	N	Level B - Periodic		
		N	Level C - Continuous		
1705.5 Wood Construction					

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1. Inspection of the fabrication process of wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review (3)	N	Periodic		
2. For high-load diaphragms, verification of grade and thickness of structural panel sheathing.	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agrees with approved bldg plans.	Field inspection	N	Periodic		
4. Metal-plate-connected wood trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic		
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill	Field inspection	Y	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Observe driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.8 Cast-in-Place Deep Foundations					
1. Observe drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
1705.9 Helical Pile Foundations					
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required	Field inspection	N	Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
1705.10.1 Structural Wood Special Inspections For Tornado Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.10.2 Cold-formed Steel Special Inspections For Wind Resistance					
1. Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.10.3 Wind-resisting Components					
1. Roof cladding	Shop (3) and field inspection	Y	Periodic		
2. Wall cladding	Shop (3) and field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.11.1 Structural Steel Special Inspections for Seismic Resistance					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 341-10, Section J2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Structural steel welding:					
a. Inspection tasks Prior to, During and After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 341-10, Table J6-1, J6-2 & J6- 3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Nondestructive testing (NDT) of welded joints in accordance with AISC 341-10, Section J6.2.	Shop (3) and field testing	Y	Periodic		
3. Structural steel bolting:					
a. Inspection tasks Prior to, During and After Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 341-10, Table J7-1, J7-2 & J7-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
4. Other Steel Structure Inspections, in accordance with QA tasks listed in AISC 341-10, Table J8-1:		Y			
a. RBS requirements	Shop (3) and field inspection	Y	Observe (4)		
b. Protected zones	Shop (3) and field inspection	Y	Observe (4)		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Composite construction:					
a. Inspection tasks Prior to, During and After Concrete Placement (Observe, or perform tasks, in accordance with QA tasks listed in AISC 341-10, Table J9-1, J9-2 & J9-3)	Field inspection	Y	Observe (4)		
1705.11.2 Structural Wood Special Inspections for Seismic Resistance					
1. Inspection of field gluing operations of elements of the seismic-force resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (3) and field inspection	N	Periodic		
1705.11.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. Inspection during welding operations of elements of the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.11.4 Designated Seismic System Verification					
Inspect and verify that that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with 1705.12.3	Field inspection		Periodic		
1. Architectural Designated Seismic Systems (per ASCE 7-10)					
a. Interior non-structural partition walls and connections	Field Inspection	N	Periodic		
b. Parapets	Field Inspection	N	Periodic		
c. Chimneys	Field Inspection	N	Periodic		
d. Exterior non-structural walls elements and connections	Field Inspection	N	Periodic		
e. Veneer	Field Inspection	N	Periodic		
f. Suspended Ceiling Systems	Field Inspection	Y	Periodic		
g. Cabinets	Field Inspection	N	Periodic		
h. Storefront and curtainwall framing	Field Inspection	N	Periodic		
i. Access Floors	Field Inspections	N	Periodic		
j. Glass in glazed interior and exterior storefront and curtainwall systems	Field Inspection	N	Periodic		
k. Laboratory Equipment	Field Inspection	N	Periodic		
2. Mechanical & Electrical Designated Seismic Systems (per ASCE 7-10)					
a. Mechanical and Electrical Components					
1) Air-side HVAC fans, air handlers, air conditioning units, air distribution boxes, and other mechanical components constructed of sheet metal	Field Inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2) Wet side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, air separators, manufacturing or process equipment and other mechanical components constructed of high-deformability materials	Field Inspection	N	Periodic		
3) Engines, turbines, pumps, compressors, and pressure vessels	Field Inspection	Y	Periodic		
4) Elevator and escalator components	Field Inspection	Y	Periodic		
5) Generators, batteries, invertors, motors, transformers, and other electrical components constructed of high deformability materials	Field Inspection		Periodic		
6) Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing	Field Inspection	N	Periodic		
7) Communication equipment, computers, instrumentation and controls	Field Inspection	N	Periodic		
8) Roof mounted stacks, cooling and electrical towers	Field Inspection	N	Periodic		
9) Light fixtures	Field Inspection	Y	Periodic		
b. Vibration Isolated Components & Systems					

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1) Components and systems isolated using neoprene elements and neoprene isolated floors with built-in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection		Periodic		
2) Spring isolated components and systems closely restrained using built in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection		Periodic		
3) Internally isolated systems and supports	Field Inspection	Y	Periodic		
4) Suspended vibration isolation equipment including in-line duct devices and suspended internally isolated components	Field Inspection	Y	Periodic		
c. Distribution Systems					
1) Piping and tubing including in-line components	Field Inspection	Y	Periodic		
2) Ductwork, including in-line components	Field Inspection	Y	Periodic		
3) Electrical conduit and cable trays	Field Inspection	N	Periodic		
4) Bus ducts					
5) Plumbing	Field Inspection	Y	Periodic		
6) Manufacturing or Process Conveyors	Field Inspection		Periodic		
7) Fire Protection Sprinkler Pipe System	Field Inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.11.5 Architectural Components Special Inspections for Seismic Resistance					
1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer.	Field inspection	Y	Periodic		
2. Inspection during the erection and fastening of interior and exterior non load bearing walls.	Field inspection	N	Periodic		
3. Inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.11.6 Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems.	Field inspection	N	Periodic		
2. Inspection during the anchorage of other electrical equipment.	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units	Field inspection	N	Periodic		
4. Inspection during the installation and anchorage of ductwork designed to carry hazardous materials	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Inspection during the installation and anchorage of vibration isolation systems.	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.11.7 Storage Racks for Seismic Resistance					
Inspection during the anchorage storage racks 8 feet or greater in height.	Field inspection	N	Periodic		
1705.11.8 Seismic Isolation Systems					
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system.	Shop and field inspection	N	Periodic		
1705.12.1 Concrete Reinforcement Testing and Qualification for Seismic Resistance					
Review certified mill test reports	Field review	N	Each shipment		
Verify reinforcing steel weldability	Review test reports	N	Each shipment		
1705.12.2 Structural Steel Testing and Qualification for Seismic Resistance					
Test in accordance with the quality assurance requirements of AISC 341-10	Shop (3) and field testing	Y	Per AISC 341		
1705.12.3 Seismic Certification of Nonstructural Components					

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
Review certificate of compliance for designated seismic system components.	Certificate of compliance review	Y	Each submittal		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.12.4 Seismic Isolation Systems					
Test seismic isolation system in accordance with ASCE 7 Section 17.8	Prototype testing	N	Per ASCE 7		
1705.13 Sprayed Fire-resistant Materials					
1. Verify surface condition preparation of structural members.	Field inspection	N	Periodic		
2. Verify application of sprayed fire-resistant materials.	Field inspection	N	Periodic		
3. Verify average thickness of sprayed fire-resistant materials applied to structural members.	Field inspection	N	Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design.	Field inspection and testing	N	Per Building Code section 1705.13.5		
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material.	Field inspection and testing	N	Per Building Code section 1705.13.6		
1705.14 Mastic and Intumescent Fire-Resistant Coatings					
Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks, in accordance with AWCI 12-B.	Field inspection	N	Periodic		
1705.15 Exterior Insulation and Finish Systems (EIFS)					
1. Verify materials, details and installations are per the approved construction documents	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Inspection of water-resistive barrier coating over sheathing substrate	Field inspection	N	Periodic		
1705.16 Fire-Resistant Penetrations and Joints					
1. Inspect penetration firestop	Field testing	N	Per ASTM E 2174		
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E 2393		
1705.17 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to concealment.	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification.	Field testing	N	Periodic		
* INSPECTION AGENTS	FIRM	ADDRESS		TELEPHONE NO.	
1.					
2.					
3.					
4.					
5.					
Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies are subject to the approval of the Building Official and/or the Design Professional. 2. The list of Special Inspectors may be submitted as a separate document, if noted so above. 3. Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2 4. Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element. 5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N7. Circle "Yes" or "No" as appropriate and date this document below: Are Requirements for Seismic Resistance included in the Statement of Special Inspections ? X Yes No Are Requirements for Tornado Resistance included in the Statement of Special Inspections ? Yes No X					

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
DATE:					

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the Statement of Special Inspections (Requirements for Seismic or Tornado Resistance) must submit a Statement of Responsibility, in accordance with the Building Code, Section 1704.4.

Project: _____

Contractor's Name: _____

Address: _____

License No.: _____

Description of building systems and components included in Statement of Responsibility:

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to achieve conformance with the approved construction documents.

Name and Title (type or print)

Signature

Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement

Project: _____

Fabricator's Name: _____

Address: _____

Certification or Approval Agency:_____

Certification Number: _____

Date of Last Audit or Approval: _____

[illegible]

Name and Title (type or print)

Signature _____

Date _____

SEAR SI GL 02 – 01/01/2014

SPECIAL INSPECTION REPORT

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:	
DATE OF INSPECTION:	
INSPECTION TYPE(S) COVERAGE	
☐ CONTINUOUS TIME BEGINNING INSPECTION:	
☐ PERIODIC TIME ENDING INSPECTION:	
DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:	
LIST TESTS MADE:	
LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:	
COMMENTS:	
TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.	
PRINTED FULL NAME	
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY	
SIGNED:	DATE:
CERTIFICATION:	NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

SPECIAL INSPECTION DISCREPANCY NOTICE

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:		
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC		
AREA INSPECTED	TYPE OF INSPECTION	
APPLICABLE DRAWING SHEET NUMBER(S) AND/OR SPECIFICATION SECTION:		
NOTICE DELIVERED TO: ☐ CONTRACTOR ☐ ENGINEER/ARCHITECT ☐ OWNER	DATE:	TIME:
MAKE THE FOLLOWING CORRECTIONS AND SECURE INSPECTION APPROVAL PRIOR TO PROCEEDING WITH THIS PHASE OF THE WORK.		
PRINTED FULL NAME		
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY		
SIGNED:	DATE:	
CERTIFICATION:	NUMBER:	
DATE RE-INSPECTED AND APPROVED AND SIGNATURE OF SPECIAL INSPECTOR:		

One copy of this report to remain at job site with the contractor for review upon request.

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	Field Testing /Inspection	Review Submittals	Review Testing, Certification, & Lab Reports
1704.2.5 Inspection of Fabricators				
Pre-cast concrete	A, C, E			
Structural steel construction	C, F, G			
Wood construction	A, N			
Cold formed metal construction	A, N			
1705.2 & 1705.11.1 Steel Construction				
Welding	C, F, G	C, F, G	A	A
High strength bolting, inspection of steel frame joint details		A, C	A	A
1705.2.2, 1705.10.2 & 1705.11.3 Steel Construction other than Structural Steel				
Welding	C, F, G	C, F, G	A	A
Screw attachment, bolting, anchoring and other fastening		A, C	A	A
1705.3 & 1705.12.1 Concrete Construction				
Reinforcing placement, cast-in-place bolts, post installed anchors, concrete and shotcrete placement and curing operations		A, C, H		
Pre-stressing steel installation		A, C, D, E		
Erection of pre-cast concrete members		A, C, H, Q		
Concrete field testing		A, C, H, I, J		
Review certified mill reports and design mixes			A	
Verify use of required design mix		A, C, H, I, J		
Pre-stressed (pre-tensioned) concrete force application	A, C, E			
Post-tensioned concrete force application		A, C, D, H		
Review of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs		A, C, D		
Reinforcing steel weldability, reinforcing welding, weld filler material		C, F, G		
1705.4 Masonry				
Review f'_m prior to construction			A	
Mortar joint construction, grout protection and placement, materials proportion, type/size/location of reinforcement, structural elements, anchorage, and connectors		A, C, K		
Sampling/testing of grout/mortar specimens		A, C, K		
Observe preparation of masonry prisms for testing of compressive strength of masonry, f'_m		A, C, K		
Inspection of welding of reinforcing steel		C, F, G		
1705.6 Soils				
Observe site preparation, fill placement and testing of compaction for compliance with the construction documents for the project		A, C, I, R		
Observe and test bearing materials below shallow foundations for ability to achieve design bearing capacity		A, L		
Review compaction testing for compliance with the construction documents for the project				A

(Table continued on next page)

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	Field Testing /Inspection	Review Submittals	Review Testing, Certification, & Lab Reports
1705.5, 1705.10.1 & 1705.11.2 Wood Construction				
Observe structural panel sheathing, size of framing members, fastener diameter and length, number of fastener lines, and spacing of fastener lines and fasteners for compliance with construction documents for the project		A, N		
1705.7, 1705.8 & 1705.9 Driven Deep, Cast-in-place Deep, and Helical Pile Foundations				
Observe installation		A, L, I		
Observe load tests		A, I		
1705.10.3 Wind Resisting Components				
Inspect roof cladding		A, B, C		
Inspect wall cladding		A, B, C		
1705.11.4 Designated Seismic Systems				
Examine designated seismic systems requiring seismic qualification and verify that the label, anchorage or mounting conform to the certificate of compliance		A	A	A
1705.11.5 & 1705.11.7 Architectural Components				
Inspection of exterior cladding, non-load bearing walls, veneer, access floors and storage racks		A, B	A, B	A, B
1705.11.6 & 1705.12.3 Mechanical and Electrical Components				
Inspection of anchorage of mechanical and electrical components		A	A	A
1705.13 Sprayed Fire-Resistant Materials				
Observe surface conditions, application, average thickness and density of applied material, and cohesive/adhesive bond		A, C		
1705.14 Mastic and intumescent fire-resistant coatings				
Observe application compliance with AWCI 12-B		A, C		
1705.15 Exterior Insulation and Finish Systems				
Inspect EIFS systems		A, B, C, M		
1705.16 Fire-resistant penetrations and joints				
Inspection of Penetration firestops		A, C, P		
Inspection of Fire-resistant joint systems		A, C, P		
[F] 1705.17 Smoke Control	See Requirements of Building Code Section [F] 1705.17.2.			
(Table continued on next page)				

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

KEY:

- A. Arkansas Professional Engineer (AR PE) competent in the specific task area or graduate of accredited engineering/engineering technology program under the direct supervision of an AR PE.
- B. Arkansas Registered Architect (AR RA) competent in the specific task area or graduate of accredited architecture/architecture technology program under the direction of an AR RA.
- C. International Code Council (ICC) Special Inspector Certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
- D. Post-tensioning Institute (PTI) Certification, Level 2.
- E. Pre-stressed Concrete Institute (PCI) Plant Quality Personnel Certification – Level III.
- F. American Welding Society (AWS) Certified Welding Inspector (CWI) or AWS Certified Associate Welding Inspector working under the direct on-site supervision of a CWI.
- G. American Society for Nondestructive Testing (ASNT) Level II certification, or a Level III certification if previously certified as a Level II in the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
- H. American Concrete Institute (ACI) Concrete Construction Special Inspector.
- I. National Institute for Certification in Engineering Technologies (NICET) Level II or higher certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
- J. ACI Concrete Field Testing Technician with Grade 1 certification or Center for Training Transportation Professionals (CTTP) Certified Concrete Field Testing Technician.
- K. National Concrete Masonry Association (NCMA) Certified Concrete Masonry Testing Technician.
- L. NICET Certified Engineering Technologist (CT) competent in the specific task area.
- M. Association of the Wall and Ceiling Industry (AWCI) EIFS Inspector Certification.
- N. International Code Council (ICC) Commercial Building Inspector Certification.
- O. International Code Council (ICC) Mechanical Inspector Certification.
- P. Inspector has passed either the Underwriters Laboratory (UL) Firestop Contractor Program Examination or the Factory Mutual (FM) Firestop Examination.
- Q. Pre-stressed Concrete Institute (PCI) Certified Field Auditor
- R. Center for Training Transportation Professionals (CTTP) Certified Soil Testing Technician.

Notes:

1. *The Special Inspector shall meet one of the minimum qualifications listed for the applicable Category of Testing and Inspection.*
2. *Materials testing shall be done by an Approved Testing Agency meeting the requirements of the Building Code Section 1703 and ASTM E 329.*

FINAL REPORT OF SPECIAL INSPECTIONS

(Completed by each Special Inspector)

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: _____

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents and approved design revisions.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered ___ to ___ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

(Attach 8 1/2"x11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

Special Inspection Agent/Firm

Type or print name of Special Inspector

Signature

Date

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heating.
 - 4. Temporary cooling.
 - 5. Temporary ventilation.
 - 6. Telephone service.
 - 7. Temporary water service.
 - 8. Temporary sanitary facilities.
- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Vehicular access.
 - 3. Parking.
 - 4. Progress cleaning and waste removal.
 - 5. Project identification.
 - 6. Fire prevention facilities.
- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Water control.
 - 5. Dust control.
 - 6. Erosion and sediment control.
 - 7. Noise control.
 - 8. Pollution control.
- D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required from utility source as needed for construction operation. Refer to electrical specifications for additional requirements.
- B. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.
- C. Permanent convenience receptacles may be utilized during construction.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations and to exterior staging and storage areas after dark for security purposes.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEATING

- A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Prior to operation of permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in product sections.

1.5 TEMPORARY COOLING

- A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Prior to operation of permanent equipment for temporary cooling purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.6 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TELEPHONE SERVICE

- A. Provide, maintain, and pay for telephone service to field office at time of project mobilization.

1.8 TEMPORARY WATER SERVICE

- A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations.

- B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.9 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.10 FIELD OFFICES AND SHEDS

- A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. When permanent facilities are enclosed with operable utilities, relocate offices and storage into building, with written agreement of Owner, and remove temporary buildings.
- D. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.
- E. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 60 00 - Product Requirements.
- F. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.
- G. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.11 VEHICULAR ACCESS

- A. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
- B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.
- D. Provide unimpeded access for emergency vehicles.
- E. Provide and maintain access to fire hydrants and control valves free of obstructions.
- F. Provide means of removing mud from vehicle wheels before entering streets.

1.12 PARKING

- A. Provide surface parking areas to accommodate construction personnel.

- B. When site space is not adequate, provide additional off-site parking.
- C. Use of existing on-site streets and driveways, and parking areas used for construction traffic is not permitted.
- D. Do not allow heavy vehicles or construction equipment in parking areas.
- E. Permanent Pavements and Parking Facilities:
 - 1. Prior to Substantial Completion, bases for permanent roads and parking areas may be used for construction traffic.
 - 2. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
 - 3. Use of permanent parking structures is permitted.
- F. Maintenance:
 - 1. Maintain traffic and parking areas in sound condition, free of excavated material, construction equipment, products, mud, snow, and ice.
 - 2. Maintain paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
- G. Removal, Repair:
 - 1. Remove temporary materials and construction at Substantial Completion.
 - 2. Remove underground work and compacted materials to depth of 2 feet; fill and grade site as specified.
 - 3. Repair facilities damaged by use, to specified condition.
- H. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

- A. Project Identification Sign: Erect sign identifying project, GC and any other pertinent information.

- B. Installation:
 - 1. Install project identification sign within 15 days after date fixed by Notice to Proceed.
 - 2. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
 - 3. Install sign surface plumb and level, with butt joints. Anchor securely.
- C. Maintenance: Maintain signs and supports clean, repair deterioration and damage.
- D. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.15 FIRE PREVENTION FACILITIES

- A. Prohibit smoking with buildings under construction and demolition. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B: C UL rating.
 - 1. Provide one fire extinguisher at building under construction and demolition.
 - 2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
 - 3. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

1.16 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.

1.17 ENCLOSURES AND FENCING

- A. Construction: Contractor's option.
- B. Exterior Enclosures: Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- C. Interior Enclosures: Provide temporary partitions as indicated on Drawings to prevent penetration of dust and moisture, and to prevent damage to existing materials and equipment.

1.18 SECURITY

- A. Security Program: Protect operations from theft, vandalism, and unauthorized entry.
- B. Entry Control:
 - 1. Restrict entrance of persons and vehicles into Project site.
 - 2. Allow entrance only to authorized persons with proper identification.
 - 3. Maintain log of workers and visitors, make available to Owner on request.

1.19 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water.

1.20 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.21 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation. Refer also to requirements stated in Civil Drawing and specifications.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.22 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise from construction operations.

1.23 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.24 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on Drawings.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.2 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

- A. Architect will consider requests for Substitutions only within 30 days after date of Owner-Contractor Agreement. Substitutions will only be allowed if proposed product matches or exceeds quality, and has same appearance as specified product.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.

3. Architect will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Testing, adjusting and balancing.
- F. Protecting installed construction.
- G. Substantial Completion.
- H. Project record documents.
- I. Operation and maintenance data.
- J. Manual for materials and finishes.
- K. Manual for equipment and systems.
- L. Spare parts and maintenance products.
- M. Product warranties and product bonds.
- N. Maintenance service.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's review.
- B. Provide submittals to Architect required by authorities having jurisdiction.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.

- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect seven days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of final inspection.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.6 TESTING, ADJUSTING AND BALANCING

- A. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.8 SUBSTANTIAL COMPLETION

- A. Notify the Architect when the Work is considered to be substantially complete. Within a reasonable time after such notification, the Architect will examine the Work to determine the status of completion.
- B. When the Architect determines that the Work is substantially complete, he will conduct a punch list observation and prepare a certificate of substantial completion accompanied by a list of the items to be completed or corrected. Architect will submit the certificate to the Owner and Contractor for their signatures.
- C. Should the Architect determine that the Work is not substantially complete, he will promptly notify the Contractor, giving reasons therefore. Contractor shall remedy the deficiencies in the Work and contact Architect to re-examine.
- D. The Architect reserves the right to add items to the punch list found during punch list check-off.

1.9 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. Submit three thumbdrives to Architect with claim for final Application for Payment.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit in thumbdrive format.
- B. Prepare printed title sheet "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project.
- C. Internally subdivide contents with dividers, logically organized as described below.
- D. Drawings: Include in CD.
- E. Contents: Prepare Table of Contents for each system, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

- a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
3. Part 3: Project documents and certificates, including the following:
- a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties.

1.11 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two thumbdrives of completed data 15 days prior to final inspection.
- B. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations.
- C. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- D. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- E. Additional Requirements: As specified in individual product specification sections.
- F. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.12 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two copies of CDs 15 days prior to final inspection.
- B. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Include servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Include control diagrams by controls manufacturer as installed.
- L. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.
- P. Additional Requirements: As specified in individual product specification sections.
- Q. Include listing in Table of Contents for design data.

1.13 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.14 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents in thumbdrives.

- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.15 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing.
- B. Related Sections:
 - 1. Section 31 20 00 - Earthwork
 - 2. Section 31 22 00 – Excavation, Backfill & Compaction for Structures
 - 3. Section 31 31 16 - Termite Control
 - 4. Section 32 12 16 - Asphaltic Concrete Paving
 - 5. Section 07 10 00 - Waterproofing

1.2 SUBMITTALS

Submit (1) set of a hard copies and (1) electronic copy of shop drawings under provisions of section 01 33 00.

- A. Shop Drawings:
 - 1. Indicate pertinent dimensioning, methods of construction, form materials, arrangement of joints and ties, location of bracing and temporary supports, schedule of erection and stripping.
 - 2. Indicate reinforcement sizes, spacing, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
 - 3. Do not submit unchecked shop drawings.
- B. Submit mix design to Architect/Engineer for approval fourteen days before placing any concrete. If fly ash is used in the project, mix designs with and without fly ash shall be submitted for every specified compressive strength of concrete used for on project.
- C. Concrete Testing: Refer to paragraph 3.9. Testing laboratory to submit results directly to Architect/Engineer.
- D. Concrete Delivery Truck Ticket: List amount of allowable field water which may be added (with Architect's approval) without exceeding water/cement ratio. If approved and added, volume of water added must be noted on field and signed by Project Superintendent.

1.3 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and 347R, unless otherwise specified in this section.
- B. Perform concrete reinforcing work in accordance with ACI 301 and ACI 315.
- C. Perform cast-in-place work in accordance with ACI 301.

1.4 SITE CONDITIONS

- A. Maintain concrete above 50 degrees F. and in a moist condition for one week minimum after placement. Refer to paragraph 3.7B for curing conditions.
- B. Place no concrete on soft or frozen ground.
- C. Concrete with fly ash shall NOT be placed when anticipated ambient temperature will be less than 60° F when concrete is placed and for 24 hours after placement.

PART 2 PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Plywood: PS 1, Class I and II, B/B Exterior or H/DO Exterior; sound undamaged sheets with clean, sealed, true edges.
- B. Form Ties: Snap-off, metal type of required length.
- C. Form Release Agent: Colorless mineral oil which will not stain concrete or impair natural bonding characteristics of coating intended for use on concrete.
- D. Vapor Retarder: 15 mil STEGO wrap barrier with tape.
- E. Waterstops:
 - 1. Center Bulb - polyvinyl chloride, 6 inch wide, maximum possible lengths; split ribbed with galvanized steel hog rings installed at one foot intervals, such as Model RSB6-38R as manufactured by Vinylex Corp.
 - 2. Bentonnite - Volclay Waterstop-RX Preformed Waterstop System by American Colloid Company (708-392-4600). Provide waterstop -RX 101RH and WB adhesive.
- F. Slab Edge Joint Filler: ASTM D1751, premolded asphaltic board, 1/2 inch thick.
- G. Waterstops for construction joints shall be center bulb, serrated type, 4' wide x 3/16" thick, with a 5/8" O.D. center bulb. All waterstops shall be polyvinylchloride (PVC) plastic waterstops similar or equal to waterstops as manufactured by Vinylex Corporation, P.O. Box 7187, Knoxville, TN. Waterstops shall meet the Corps of Engineers specification for PVC waterstops (No. CRD-C-572-63).
- H. Dovetail anchors and anchor slots shall be provided along concrete walls with masonry shelves 1'-2" or deeper.
 - 1. Dovetail anchor slots shall be of 22 gage, hot dipped galvanized steel and foam filled as required. They shall be 1" wide x 1" deep with a 5/8" throat. Space at 24" o.c. horizontal unless noted.
 - 2. Dovetail anchors shall be as per specification Section 04 20 00. Provide at 16" o.c. vertically unless noted.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish.

- B. Welded Steel Wire Fabric: ASTM A185 Plain type, in flat sheets, plain finish, free from rust, in sizes shown on Drawings.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing.
- D. Fabricate concrete reinforcing in accordance with ACI 318.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type I Portland type.
- B. Fly Ash: Approved Class C.
- C. Fine Aggregate: ASTM C33; clean, fresh water, sand graded uniformly to conform to paragraph 4 of Specification C33.
- D. Coarse Aggregate: ASTM C33; standard grading size 1 - 1 1/4" to No. 4 of washed gravel or crushed stone.
- E. Water: Clean and not detrimental to concrete, supplied direct from the city water main.
- F. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.4 COMPOUNDS AND SEALERS

- A. Chemical Sealer: Liquid acrylic styrene type such as Kure & Seal as manufactured by ProSo Co, or approved equal.

2.5 BONDING AGENT

Polyvinyl acetate or acrylic base.

- A. Polyvinyl Acetate (Interior Only): Euclid "Euco Weld", L&M "Everweld", or approved equal.
- B. Acrylic or Styrene Butadiene: Euclid ASBR Latex", L&M "Everbond", Master Builders "Acryl-Set", Sonneborn "Sonnocrete", or approved equal.

2.6 EPOXY ADHESIVE

- A. ASTM C881. Two component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit project requirements.
 - 1. Conspec: Spec-Bond 100, Euclid "Euco Epoxy System #452 or #620, L&M "Epabond", Master Builders "Concresive Standard Liquid", or approved equal.

2.7 CONCRETE MIX

- A. Mix Design:
 - 1. Prepare mix designs for each type of concrete, in accordance with ACI 301 & ACI 318.
 - 2. Mix designs are to be performed by an independent testing lab.

- B. Mix and deliver concrete in accordance with ASTM C94.
- C. Provide concrete of the following strength:
 - 1. See plans for minimum concrete strengths and placement.
 - 2. Maximum Slump:
 - a. Footings, Foundations: 4 inches
 - b. Slab: 4 inches
 - c. Grade Beam: 4 inches
- D. Do not mix salt, chemicals, or other foreign materials for the purpose of preventing freezing. Use no admixtures without prior approval of the Architect/Engineer.
- E. Fly ash content shall be no more than 20% of the total cement content measured by weight.
- F. Add air entraining agent to concrete mix for concrete work exposed to exterior.
- G. Job-Site Mixing: Not allowed.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements. Erect formwork for grade beams - do not place concrete in earth-formed trenches.
- B. Camber slabs and framing to achieve ACI 301 tolerances.
- C. Provide bracing to ensure stability of formwork. Forms are not to deflect under weight of wet concrete or construction loads.
- D. Provide chamfer strips on external corners of curbs, walls & columns.
- E. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.
- F. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.
- G. Clean forms as erection proceeds, to remove foreign matter.
- H. Complete steel placement and foundation forming promptly after excavations are exposed to reduce the possibility of changes in strength and compressibility characteristics of the soil.
- I. Coordinate with Section 07 10 00 for waterproofing.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.

- B. Coordinate work of other sections in forming and setting openings, waterstops, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install concrete accessories straight, level, and plumb.
- D. Install center bulb waterstops continuous without displacing reinforcement. Heat seal joints watertight.
- E. Install Bentonite waterstops continuous as per manufacturer's written instructions
- F. Clean existing surfaces and apply adhesive prior to placing waterstop. Place joint filler at perimeter of floor slab, penetrations, and isolation joints.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- C. Support footing reinforcement on snap-on paving chair/base.
- D. Wire dowels to longitudinal bars. Align top of bars with wood templates placed 2 inches from the top.
- E. Support wire mesh on snap-on mesh chair/base.
- F. Bar supports snap-on paving chair/base.
- G. Top bars in footing hang - do not float.
- H. Notify Architect 48 hours before placing any concrete.

3.4 PLACING CONCRETE

- A. Comply with ACI 304 "Recommended Practice For Measuring, Mixing, Transporting & Placing Concrete"; and as specified below.
- B. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.
- C. Separate slabs-on-grade from vertical surfaces with 2 inch thick joint filler, extended from bottom of slab to within 1/4 inch of finished slab surface.
- D. Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place floor slabs in checkerboard or saw cut pattern indicated.
- F. Provide expansion joints as detailed, in concrete walks at 20 feet maximum and where walks terminate at other Work. Provide control joints at equal intervals, at 5 feet

maximum. Construct joints straight and perpendicular to the finished surface. Elevations on adjacent sides of joints must not vary more than 0.10".

- G. Where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrink grout, unless noted otherwise.
- H. Dampen exposed grades in hot weather.
- I. Do not add any field water without Architect's approval.
- J. Screed floors or slabs-on-grade level.
- K. Conveying: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials.
- L. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.
- M. Placing Concrete in Forms: 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 preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, roding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 - a. Do not use vibrators to transport concrete inside forms.
- N. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Maintain reinforcing in proper position during concrete placement.
- O. Cold Weather Placing: Comply with the requirements of ACI 306 and as follows:
 - 1. Protect concrete work from physical damage and reduced strength that could be caused by frost, freezing actions, and low temperatures.
 - 2. Do not use calcium chloride and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted for mix design.
- P. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with the requirements of ACI 305.

3.5 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Remove formwork progressively and in accordance with code requirements.

- C. Remove forms at exposed walls as soon as possible and break back metal form ties. Wet and fill voids with cement mortar.

3.6 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Uniformly spread, screed, and float concrete.
- C. Steel trowel surfaces which will receive flooring materials or which will be left exposed.
- D. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft.
- E. In areas with floor drains, maintain floor level at walls and slope surfaces uniformly to drains.
- F. Provide medium broom finish at exterior walks and steps. Provide rough broom finish at exterior ramps.
- G. Provide vertical concrete surfaces to be left exposed with smooth rubbed finish.
- H. Apply concrete sealer on floor surfaces as scheduled. Apply in accordance with manufacturer's instructions.

3.7 CURING

Perform curing of concrete and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as specified. Cure all concrete a minimum of 7 days.

- A. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
- B. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- C. Provide curing and sealing compound on interior slabs; and to exterior slabs, walks, and curbs, as follows:
 - 1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Maintain continuity of coating and repair damage during curing period.
 - 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
 - 3. Do not use curing and sealing compounds to receive special floor finishes (poured epoxy finishes, synthetic sports flooring, etc.).

- D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.8 DEFECTIVE CONCRETE

- A. Replace concrete not conforming to required density lines, details and elevations, as directed by Architect/Engineer.

3.9 FIELD SAMPLING AND TESTING

- A. The following samples and tests will be performed by an independent testing laboratory approved by Owner and Architect. The contractor is for responsibility for payment of test.
- B. Samples:
 - 1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of 6 test cylinders and one slump test for each 50 cubic yards of concrete from each day's pour. In accordance with ASTM C-138, ASTM C 173 Volumetric Method, or ASTM C 231 Pressure Method, make one unit weight and air content check for each set of test cylinders. Air content and slump shall be checked and recorded at both truck discharge and point of placement for pumped concrete from the first load each day.
 - 2. Test cylinders as follows for compressive strength: one at 7 days, two at 28 days, and one reserve for testing after a longer period as required by Architect, if the 28 day tests do not meet the required strength. Test one cylinder, tested at 24 hours and one cylinder at 28 days for oven dry density per ASTM C-567.
 - 3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.
 - 4. Additionally, test slump every 25 cu. yds., recording location for report.
 - 5. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.
- C. Testing:
 - 1. Where average strength of any group of 3 cylinders falls below the minimum compressive strength or of individual cylinder falls more than 500 psi below minimum compressive strength specified, the Architect shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Architect from location in structure represented by that specimen or specimens which failed.
 - 2. Specimens shall be secured, prepared, and tested in accordance with ASTM C 42, within a period of 60 days after placing concrete.
 - 3. Concrete shall be considered to meet the strength requirement of this specification if it meets the strength requirements of paragraph 5.6.5 of ACI 318.
 - 4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.
 - 5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor. Even if

test specimens prove concrete meets project specifications.

6. The holes from which the cored samples are taken shall be packed solid with no lump concrete proportioned in accordance with the ACI 211 "Recommended Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have the same design strength as the specified concrete.
7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.5 of latest ACI 318, the Architect shall have the right to require any and all defective concrete to be replaced, and all costs resulting there from shall be borne by the Contractor.

- D. Contractor Sampling: In addition to the slump tests specified above, the Contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Architect, immediately perform a slump test in accordance with ASTM 143. Concrete not meeting the slump requirements shall be removed from the job site.

3.10 PROTECTION

- A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.
- B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.

END OF SECTION

SECTION 03 31 16

STRUCTURAL LIGHTWEIGHT CONCRETE

PART 1 GENERAL

1.1 SCOPE: Provide Lightweight Concrete Work and Related Items Complete.

1.2 RELATED WORK:

- A. Cast-In-Place Concrete: Section 03 30 00
- B. Structural Steel: Section 05 12 00
- C. Steel Floor Deck: Section 05 31 13
- D. Composite Steel Deck: Section 05 36 00

1.3 SUBMITTALS: Comply with Section 01 33 23.

- A. Product Data: Submit manufacturer's product data for admixtures and curing compounds and other as requested by Architect.
- B. Design Mix: Prior to placement for concrete, submit concrete mix designs proposed by the concrete supplier, for class of concrete, including recent test results substantiating the quality of concrete produced by each mix.
- C. Product data and mix design shall be submitted to the architect for approval as one hard copy (not to be returned) and one electronic copy in PDF format as per section 01 33 23.
- D. Reports: Weekly reports of all compression, slump, and air content tests from the testing laboratory.

1.4 QUALITY ASSURANCE:

- A. Codes And Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are indicated or specified, and except as accepted or directed by Architect during unusual climatic conditions.
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete?"
 - 3. CRSI "Manual of Standard Practice".
- B. Local Codes and Ordinances: Wherever provisions of the Standard Building Code or the local current ordinances are more stringent than the above specifications and standards, the local codes and ordinances shall govern.
- C. Subcontractors Requirements:
 - 1. Ready Mix Producer: Shall have experience in producing lightweight aggregate concrete.
 - 2. Ready Mix Producer, Pumping Contractor and Concrete Finisher: If lightweight aggregate concrete is pumped, each of these contractor/suppliers must have experience on a minimum of 3 previous projects in which lightweight aggregate

concrete was pumped.

- D. Concrete Testing Service: Engage a testing laboratory acceptable to Owner and Architect to perform material evaluation tests and to design concrete mixes.
1. At Contractor's expense, a certified ACI technician shall make test cylinders at the site.
 2. Tests for retesting of rejected materials shall be paid for by the Contractor. Testing requirements are specified in FIELD SAMPLING AND TESTING paragraph.

1.5 REFERENCE STANDARDS:

- A. American Society for Testing & materials (ASTM):
1. C 31 Practice for Making and Curing Concrete Test Specimens in the Field
 2. C 33 Specification for Concrete Aggregates
 3. C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 4. C 94 Specification for Ready-Mix Concrete
 5. C 138 Test method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 6. C 143 Test Method for Slump of Hydraulic Cement Concrete
 7. C 150 Specification for Portland Cement
 8. C 172 Practice for Sampling Freshly Mixed Concrete
 9. C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 10. C 260 Specification for Air-Entraining Admixtures for Concrete
 11. C 330 Specification for Lightweight Aggregates for Structural Concrete
 12. C 494 Specification for Chemical Admixtures for Concrete
 13. C 567 Test Method for unit Weight of Structural Lightweight Concrete
 14. C 595 Specification for Blended Hydraulic Cements
 15. C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
 16. C 845 Specification for Expansive Hydraulic Cement
 17. C 989 Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
 18. C 1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 19. C 1240 Silica Fume for Use in Hydraulic Cement Concrete and Mortar
- B. American Concrete Institute (ACI)
1. ACI 211.2 Standard Practice for Selecting Proportions for Structural Lightweight Concrete
 2. ACI 301 Specifications for Structural Concrete for Buildings
 3. ACI 318 Building Code Requirements for Reinforced Concrete

1.6 STORAGE OF MATERIALS:

- A. Cement: Store in accordance with ACI 318.
- B. Aggregates: Each gradation and type shall be stockpiled separately. Storage shall minimize segregation and prevent contamination.

PART 2 PRODUCTS

2.1 MATERIALS:

- A. Aggregate: Expanded Shale, Clay, or Slate (ESCS) lightweight aggregate produced by the rotary kiln method shall meet ASTM 330. Normal weight aggregate shall meet ASTM C 33.
- B. Cement: Shall meet ASTM C 150, C 595, or C 845.
- C. Silica Fume: Shall meet ASTM C 1240.
- D. Fly Ash: Shall meet ASTM C 618.
- E. Ground Granulated Blast-Furnace Slag: Shall meet ASTM C 989.
- F. Mixing Water: Shall meet ACI 318.
- G. Air-Entraining Admixtures: Shall meet ASTM C 260.
- H. Chemical Admixtures: Set-controlling and water-reducing admixtures shall meet ASTM C 494 and the manufacturer's recommendations.

2.2 CONCRETE PROPERTIES:

- A. Strength: Materials shall be proportioned to produce concrete with a minimum compressive strength of 4000 psi at 28 days.
- B. Unit Weight: Materials shall be proportioned to produce concrete with a calculated equilibrium unit weight of 110 lbs/ft³; as determined by ASTM C 567, Section 9.5.
- C. Slump: Concrete shall be delivered at the minimum nominal slump necessary for efficient mixing, placing, and finishing. The maximum slump shall be 4 inch with a tolerance of 1 in. plus/minus. Consult ASTM C 94 for guidance on tolerances.
- D. Air: The air content shall be 5 percent by volume with a tolerance of plus/minus 1.5 percent.
- E. Mixture Design:
 - 1. The contractor shall furnish the mixture design for the strength and unit weight of the concrete specified. The mixture design shall be prepared in accordance with ACI 318, and subject to the approval of the architect/engineer.
 - 2. Provide test results from the concrete supplier for proposed design mix, to establish the following:
 - a. Gross weight and yield per cu. yd. of trial mixtures.
 - b. Measured slump.
 - c. Measured air content.
 - d. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7 and 28 day test, and for each design mix.
 - 3. Submit written reports to Architect for design mixes at least 7 calendar days prior to the start of work.
- F. Batching and Mixing: The concrete shall be batched and mixed in accordance with the applicable section of ACI 301 and ASTM C 94.

- 2.3 Liquid Membrane-Forming Curing Compound: ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. Cm. When applied at 200 sq. ft./gal. Conspec :Conspec #1", L&M "L&M Cure R", Sonneborn "Kure-N-Seal", Euclid "Eurocure", Master Builders "Masterkure", W.R. Meadows "Sealtight CS-309", or approved equal.

PART 3 EXECUTION

3.1 CONCRETE PLACEMENT:

- A. Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- B. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied to cushion fill before vapor barrier and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.
- C. Notify Architect 48 hours before placing any concrete.
- D. Conveying: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Provide equipment for chuting and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. All equipment and methods used for conveying are subject to the approval of Architect.
- E. Pumping: If lightweight concrete is to be pumped, follow the requirements of ACI 304.2R and Expanded Shale Clay and Slate Institutes information sheet #4770.1.
 - 1. Pre-construction meeting: Prior to pumping lightweight concrete (LWC), a pre-construction meeting shall be held. Representatives of the Architect, general contractor, ready mix producer, pumping contractor, testing agency, and concrete finishers shall be present. The purpose of the meeting is to discuss coordination of all sub contractors involved in the placement of LWC>
 - 2. Prior to placement, the mix design must be adjusted by the testing agency to accommodate pumping.
 - 3. Slump will be measured at the discharge end of the pump line.
 - 4. Lubricate pump lines before placing concrete.
 - 5. Carefully coordinate batching, delivery and placement of concrete so as to continuously place concrete. Also, trucks must discharge load within 45 minutes of batching.
 - 6. Minimum size of pump line is 5 inches. Use steel lines with rubber at the discharge end.
- F. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

- G. Placing Concrete In Forms: 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 preceding layer is still plastic to avoid cold points.
1. Consolidate 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 309.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 3. Maintain reinforcing in proper position during concrete placement.
- I. Cold Weather Placing: Comply with the requirements of ACI 306 and as follows:
1. Protect concrete work from physical damage and reduced strength that could be caused by frost, freezing actions, and low temperatures.
 2. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.
 - a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - b. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted for mix designs.
- J. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with the requirements of ACI 305 and as follows:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option,
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
 3. When acceptable to Architect, and when required by high temperature, low humidity, or other adverse placing conditions, use an approved water-reducing retarding admixture.

3.2 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. 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 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 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 curing and sealing compound.
 - 1. Provide curing and sealing compound on interior slabs left exposed as follows:
 - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

3.3 FIELD SAMPLING AND TESTING

- A. The following samples and tests will be performed by an independent testing laboratory approved by Owner and Architect. Refer to paragraph 1.4.4 for responsibility for payment of tests.
- B. Samples:
 - 1. Field samples shall be made and cured in accordance with ASTM C 31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 50 cubic yards of concrete from each day's pour. In accordance with ASTM C 173 Volumetric Method, make air content check for each set of test cylinders. Air content and slump shall be checked and recorded at both truck discharge and point of placement for pumped concrete from the first load each day.
 - 2. Test cylinders as follows: one at 7 days, two at 28 days, and reserve the remaining for testing after a longer period as required by Architect, if the 28 day tests do not meet the required strength.
 - 3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.
- C. Testing:
 - 1. Where average strength of any group of 3 cylinders falls below the minimum compressive strength or of individual cylinder fall more than 500 psi below minimum compressive strength specified, the Architect shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Architect from location in structure represented by test specimen or specimens which failed.
 - 2. Specimens shall be secured, prepared, and tested in accordance with ASTM C 42, within a period of 60 days after placing concrete.
 - 3. Concrete shall be considered to meet the strength requirement of this specification if it meets the strength requirements of paragraph 5.6.4 of ACI 318.
 - 4. Should laboratory analysis indicate that the proper concrete mix has not been used by the contractor, all such concrete poured using the improper mix shall be subject

to rejection.

5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.
6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with the ACI 211 "Recommended Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have the same design strength as the specified concrete.
7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.4 of ACI 318, the Architect shall have the right to require any and all defective concrete to be replaced, and all costs resulting there from shall be borne by the Contractor.

3.4 PROTECTION

- A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.
- B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.
- C. Protect exposed concrete floors, steps, and walks from paint and other materials or equipment which may mar or damage these surfaces.

3.5 CLEAN-UP

- A. Do not allow debris to accumulate. Clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of entire cast-in-place concrete work.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Structural steel framing members, base plates, plates, anchor bolts, grouting under base plates, steel lintels and miscellaneous steel shapes.
- B. Related Sections:
 - 1. Cast-In-Place-Concrete: Section 03 30 00
 - 2. Steel Roof Deck: Section 05 31 23
 - 3. Steel Floor Deck: Section 05 31 13
 - 4. Composite Steel Deck: Section 05 36 00
 - 5. Metal Fabrications: Section 05 50 00
 - 6. Painting Section 09 90 00

1.2 SUBMITTALS:

- A. Shop Drawings:
 - 1. Submit (1) set of a hard copy and (1) electronic copy of Shop Drawings for review of general conformance to design concept in accordance with Section 01 33 00.
 - 2. Indicate sizes, spacing, and locations of structural members, openings, connections, cambers, loads, and welded connections. Indicate welds by standard AWS symbols and show size, length, and type. Provide setting drawings and templates for installing A bolts and other anchorages installed by others.
- B. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.

1.3 QUALITY ASSURANCE

- A. Codes And Standards: Comply with the provisions of the following:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
 - 2. AISC "Specifications for Structural Steel Buildings", including "Commentary".
 - 3. AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" approved by the Research Council on Structural Connections.
 - 4. AWS D1.1 "Structural Welding Code - Steel".
- B. Welding operators shall be qualified in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous months. If recertification of welders is required, provide without additional cost to Owner.

1.4 PERFORMANCE REQUIREMENT

- A. Connection Design: Engineer and fabricate all "simple framed" shear connections to meet requirements shown on plans unless otherwise noted.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts or nuts become dry or rusty, clean and re-lubricate before using.

1.6 INSPECTION OF FABRICATORS

- A. Approved fabricators are not required to have special inspections as required by Section 1704.2.5 of the IBC 2012 code.
- B. Fabricators that are in good standing members of AISC are considered approved. Other fabricators not members of AISC shall submit the fabricator's written procedural and quality control manual and periodic auditing of fabrication practices by an approved special inspection agency prior the start of fabrication. This shall be at the fabricator's expense.
- C. Approved fabricators shall submit a certification of compliance found in Section 01 40 10 "Special Inspections" to the building official at the completion of fabrication.
- D. All fabricators that not approved shall undergo special inspection as required by Section 1704.2.5 of the IBC 2012.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Rolled Structural Steel Members, Wide flange: ASTM A992, Grade 50.
- B. Channel, Angles and Bent Plates Less than ½" Thick: ASTM A36 grade 36ksi
- C. Bars, Bent Plates ½" Thick or Greater and Flat Plates ½" Thick or Greater: ASTM A572, Grade 50 ksi.
- D. Structural Tubing: ASTM A500, Grade C, Fy = 50 ksi.
- E. Pipe: ASTM A53, Type E or S, Grade B, seamless.
- F. High Strength, Threaded Fasteners (Bolts, Nuts, and Washers): ASTM A325, Type 1.
- G. Unfinished Threaded Fasteners (Anchor Bolts): ASTM F1554, Grade 36 ksi, Grade A.
- H. Threaded Rod: ASTM A36.

- I. Welding Materials: AWS D1.1; E70XX. Welding rods used in shop and field for welding on lateral columns, beams and braces shall be "seismic rods".
- J. Headed Stud-Type Shear Connectors: ASTM A108, cold-finished carbon steel with dimensions complying with AISC specifications. Minimum tensile strength shall be 60 ksi and minimum yield strength is 50 ksi.
- K. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days. Euclid "Euco N.S.", Master-Builders Master Flow 713", Conspec "100 Non-Shrink Grout (Non Metallic)" or approved equal.
- L. Shop and Touch-Up Primer: Meet performance required of TT-P-86, lead free, alkyd primer.
- M. Sleeve Anchors in Masonry: Federal Specifications A-A-1922A.
- N. Expansion Anchors in Concrete and Grouted CMU:
 - 1. In concrete: ICC-ES AC193. Acceptable anchors are Hilti KWIK Bolt-TZ (ICC-ESR-1917) or Simpson Strong-Bolt 2 (ICC-ES ESR-3037) or Powers Power-Stud+SD2 (ICC-ES-ESR 2502) or Powers Power Stud+SD1 (ICC-ES-ESR 2818).
 - 2. In Solid Grouted Concrete Masonry Units: ICC-ES AC01. Acceptable anchors are Hilti KWIK Bolt 3 (ICC-ESR-1385) or Simpson Wedge-All (ICC-ES ESR-1396) or Simpson Strong-Bolt 2 (IAPMO-ES ER240) or Powers Power –Stud+SD1(ICC-ES-ESR 2966).
- O. Screw Anchors in Concrete, Grouted CMU, and Hollow CMU:
 - 1. In concrete: ICC-ES AC193. Acceptable anchors are Hilti KWIK HUS-EZ and KWIK HUS-EZ I (ICC-ESR-3027) or Simpson Titen HD and Titen HD Rod hanger (ICC-ESR-2713) or Powers Power Wedge Bolt+ (ICC-ES-ESR 2526)
 - 2. In Solid Grouted Concrete masonry Units: ICC-ES AC106. Acceptable anchors are Hilti KWIK HUS-EZ (ICC-ESR-3056) or Simpson Titen HD (ICC-ESR-1056) or Powers Power Wedge bolt+ (ICC ES-ESR 1678).
 - 3. In Hollow Concrete Masonry Units: Acceptable anchors are Simpson Titen HD.
- P. Adhesive Anchors:
 - 1. In Unreinforced Masonry Units: ICC-ES AC60. Acceptable adhesives are Hilti HIT-HY 70 (ICC-ESR-3342) Simpson SET (ICC-ES ESR-1772). AT (ICC-ES ESR-1958) or Powers AC100+Gold (ICC-ES-ESR-3200). Steel anchor element shall be Hilti HAS-E or ASTM F1554 Grade 36 continuously threaded rod.
 - 2. In Hollow Concrete Masonry Units: ICC-ES AC58. Acceptable adhesives are Hilti HIT-HY 70 (ICC-ESR-2682), Simpson SET, Simpson AT or approved equal. Plastic Mesh Screen Tube per Manufacturer recommendations required. In Solid Grouted Masonry Units: ICC-ES AC58. Acceptable adhesives are Hilti HIT-HY 70 (ICC-ESR-3342), Simpson SET-XP (IAPMO UES-ER 265), or Simpson AT-XP (IAPMO UES-ER 281) or Powers AC+Gold (ICC ES-ESR -3200). Steel anchor element shall be Hilti HAS-E, ASTM F1554 Grade 36, or ASTM A193, Grade B6, B8, or B8M continuously threaded rod.
 - 3. In concrete: ICC-ES AC308. Acceptable anchors are Hilti HIT-HY 200 SAFE Set fast cure (ICC-ESR-3187), Hilti HIT-RE 500-SD slow cure (ICC-ESR-2322), Simpson SET-XP (ICC-ESR-2508), Simpson AT-XP (IAPMO UES-ER263), Powers Pure 110+

Epoxy System for standard cure (ICC-ES-ESR 3298) or Powers AC100+Gold+ Acrylic System for Fast cure (ICC-ES-ESR-2582) or approved equal. Steel anchor element shall be Hilti HAS-E, ASTM F1554 Grade 36, or ASTM A193, Grade B6, B8, or B8M continuously threaded rod.

Q. Undercut Anchors:

1. In Concrete: ICC-ES AC193. Acceptable anchors are Hilti HDA (ICC-ESR-1546) or Simpson Torq-cut (ICC-ESR-2705) or Powers Atomic+ Undercut anchor (ICC-ES-ESR 3067).

2.2 Connector shall conform to the following:

- A. Headed Stud Shear Connectors: ASTM A108, $F_y=51\text{ksi}$, $F_u=65\text{ ksi}$ minimum ultimate tensile strength. Studs shall be solid fluxed attached with appropriate stud gun capable of meeting the strengths set forth in Table 1.11.4 AISC Specification.
- B. Headed Concrete Anchors: ASTM A108, $F_y=49\text{ ksi}$, $F_u=65\text{ksi}$ minimum ultimate tensile strength.
- C. Threaded Studs: ASTM A108, $F_y=49\text{ksi}$, $F_u=61\text{ ksi}$ minimum ultimate tensile strength.

2.3 MECHANICAL EQUIPMENT FRAMES

All mechanical equipment frames or miscellaneous steel required to complete the mechanical equipment installation shall be provided and detailed by the structural steel fabricator. The mechanical equipment contractor shall provide all necessary weights and dimensions to the structural steel fabricator. Shop drawings for mechanical and equipment frames must be submitted and accepted by the Architect.

2.4 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 2. Where shop finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaced of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
 1. Bolt field connections, except where welded connections or other connections are indicated.
 2. Provide high-strength threaded fasteners for principal bolted connections, except where otherwise indicated.
 3. High-Strength Bolted Construction:
 - a. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".
 - b. Alternate High Strength Bolts: Standard Specification Twist Off Type Tension Control Structural Bolt/Nut/Washer Assembly ASTM F-1852-08.

120/105 min. tensile strength.

4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
5. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end of welding of headed stud shear connectors in accordance with manufacturer's printed instructions.
6. Holes For Other Work: Provide holes for securing other work to structural steel framing and for passage of other work through steel framing members, as indicated on final shop drawings.
 - a. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
 - b. Cut, drill, or plumb holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.5 SHOP PAINTING

- A. Shop paint all structural steel, except as follows:
 1. Members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on the exposed portions and the initial 2" of embedded areas only.
 2. Members to be welded.
 3. Members to be fire proofed.
- B. Surface Preparation: Before painting, thoroughly clean all surfaces of all grease, rust, welding droppings and loose mill scale by methods conforming to SSPC-SP-1 and SSPC-SP-3. After erection, wire-brush and touch-up welded or abraded areas. Touch-up with primer.
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions and at a rate to provide a uniform dry film thickness of 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges and all exposed surfaces.

PART 3 EXECUTION

3.1 ERECTION

- A. Brace and guy members until final connections are made. Structure is not stable until all members, connections, decking, slabs, bracing, and other structural components are in place and secured.
- B. Setting Bases and Bearing Plates: Clean bearing surfaces of bond-reducing materials and roughed to improve bond to surfaces. Clean bottom of base and bearing plates.
 1. Set loose and attached bearing plates and bearing plates for structural members on wedges or other adjusting devices.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain.

- C. Field Erection:
 - 1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clear bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 2. Level and plumb individual members of structure within specified AISC tolerances.
- D. Field Alterations:
 - 1. Do not field cut or alter structural members without the approval of Architect.
 - 2. Do not enlarge holes by burning or using a spud wrench or drift pin.

3.2 WELDING

- A. Welding in shop and field shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society, "Standard Qualification Procedure." All operators must have successfully passed the welding qualification tests within a 24-month period preceding erection. The Architect shall be provided a copy of the welding qualification test for each operator at no additional cost to the Owner.
- B. Equipment to be of a type which will produce proper current so that operator may produce satisfactory welds. Welding machine shall be of 200-400 ampere, 25-40 volt capacity.
- C. Electrodes shall be suitable for positions and other conditions of intended use in accordance with the instructions with each container.
- D. Field welding shall be done by direct current.
- E. Technique of welding employed, the appearance and quality of welds made and methods of correcting defective work shall conform to American Welding Society "Code for Arc Welding in Building Construction", Section 4, "Workmanship".
- F. Surfaces to be welded shall be free from loose scale, rust grease, paint and other foreign material except that mill scale withstanding vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. Joint surfaces shall be free from fins and tears.
- G. No welding shall be performed when temperature of the base metal is lower than 0 degrees F. At temperatures between 32 degrees F and 0 degrees F., the surfaces of all areas within 3" of a point where a weld is started shall be heated until they are too hot to touch before welding is started.
- H. Finished members shall be true to line and free from twists, bends and open joints.

3.3 TESTS

- A. Laboratory tests. Methods of testing shall be according to the following:

STRUCTURAL STEEL - ASTM A-36, ASTM A572, or ASTM A992. Two tension tests from

each melt. Two bend tests from each melt.

STEEL ELECTRODES - ASTM A-233. As directed.

B. Field Tests. All field and shop welders shall be tested and certified by an approved testing laboratory. The American Welding Society Operator Qualification test shall be used as a basis of qualification.

C. All field and shop operators shall qualify for the following:

Type of Weld	Position of Welding
Groove	Horizontal
Groove	Vertical
Groove	Overhead
Fillet	Vertical
Fillet	Overhead

D. The Architect's Representative may require strap cuts from welds in any supporting member to withstand nick-break test. If strap fails to meet requirements, Contractor shall replace strap cut from member at no charge to Owner. If strap does meet requirements, the Architect shall pay expenses of having metal replaced. In event strap fails, the welder shall be discharged.

3.4 OBSERVATION

The work shall be observed in the shop and the field.

3.5 TOUCH-UP PAINTING

Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on structural steel is included in Section 09 90 00.

END OF SECTION

SECTION 05 31 13

STEEL FLOOR DECK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel non-composite floor deck and accessories for forming of concrete floors.
 - 2. Frames openings up to 10 inches by 10 inches.
 - 3. Welding, fasteners, and accessories for attachment of deck.
- B. Related Sections:
 - 1. Cast-In-Place-Concrete: Section 03 30 00
 - 2. Structural Steel: Section 05 12 00
 - 3. Metal Fabrications: Section 05 50 00.

1.2 SUBMITTALS:

- A. Shop Drawings:
 - 1. Submit (1) set of hard copies and (1) electronic copy of Shop Drawings for review of general conformance to design concept in accordance with Section 01 33 00.
 - 2. Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence or installation.
- B. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.

1.3 QUALITY ASSURANCE

- A. Steel deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) "Specifications and Commentary for Non-Composite Steel Form Deck."
- B. Welding operators shall be qualified in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to owner.

1.4 REFERENCE STANDARDS

- A. AISI - "Specification for the Design of Cold-Formed Steel Structural Members."
- B. ASTM A36 and A572 - Structural Steel.
- C. ASTM 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- D. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.

- F. AWS D1.1 - Structural Welding Code.
- G. AWS D1.3 - Specification for Welding Sheet Steel in Structures.
- H. SDI - "Design Manual for Composite Decks, Form Decks, Roof Decks."
- I. AISC - "Manual of Steel Construction."
- J. SDI - Diaphragm Design Manual

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials off ground with one end elevated on wood sleepers to provide drainage.
- B. Prevent damage to edges, ends and surfaces.
- C. Cut plastic wrap to encourage ventilation. Keep materials dry.
- D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Vulcraft A Division of Nucor Corporation.

2.2 MATERIALS

- A. Sheet steel shall conform to ASTM A611 Grades C,D, or E for painted decks and ASTM 653-94 structure quality for galvanized decks.
 - 1. Fluted Decks and Ribbed Steel Forms 1-1/2 inches or higher shall be formed from sheet steel having a minimum yield strength of 33,000 PSI.
 - 2. Ribbed Steel Forms less than 1-1/2 inches high shall be formed from sheet steel having a minimum yield strength of 60,000 PSI.
- B. Bearing Plate and/or Angles shall be ASTM A572 steel.
- C. Welding Methods and Materials shall conform to AWS D1.1 and AWS D1.3.
- D. Metal Closure Strips, Wet Concrete Stops, Cover Plates and Related accessories shall be a minimum of 22 gage sheet steel of required profiles and sizes.
- E. Finish:
Galvanizing shall conform to the requirements of ASTM A653-94 coating class G60. Shop Primer shall be acrylic medium gray. Touch-up primer shall be compatible with manufacturer's primer.
- F. Mechanical fasteners shall be Teks as manufactured by Buildex, St. Charles Road, Elgin, Illinois 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer's recommendations.

2.3 FABRICATION

- A. Steel Form Deck (metal centering) shall have formed ribs of the type, finish, dimension and gage shown on Drawings.
- B. Deck shall be capable of supporting loads indicated on the Drawings. Structural capacity of deck sections shall be established from section properties computed in strict accordance with the latest edition of the Steel Deck Institute "Design Manual for Composite Decks, Form Decks and Roof Decks". The maximum working stress shall not exceed the yield strength divided by 1.65. Minimum thickness of material supplies shall be within 5% of design thickness.
- C. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate Steel Deck and Ribbed Metal Forms to lap a minimum of 2" over supports at ends.
- D. Bearing lengths shall be established in accordance with the latest edition of the Steel Deck Institute's "Design Manual for Composite Decks, Form Decks and Roof Decks and shall be consistent with the deck capacity established in paragraph 2.03 B.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Deck and accessories shall be installed in accordance with the manufacturer's shop and erection drawings. Minimum bearing shall not be less than 1-1/2" inches.
- B. Fasten steel deck units to structural supports using Hex washer head Tek's or arc spot welds according to manufacturer's specifications and erection layouts and as specified herein. Decks thinner than .0280 inches shall be welded using 16 ga. welding washers with a 3/8" diameter hole. Side lap connections shall be screwed.
- C. Arc spot welds (puddle welds) to support shall have a diameter (weld nugget) of 3/8" minimum. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard "Specification for Welding Sheet Steel in Structures", AWS D1.3.
- D. Fastening of deck to supports and side laps.
 - 1. Deck ends at building perimeter: 6" o/c
 - 2. Deck end laps: 6" o/c (36/4 min.)
 - 3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than four feet shall be fastened at midspan or at 24" intervals whichever is smaller.
 - 4. See drawings for requirements beyond these minimum requirements.
- E. At ends of decks or where changes of deck direction occur, fasten at 6" o.c. Furnish and install adequate closures and fasten to both sides at 6" o.c.
- F. Cutting openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.

- G. Install sheet steel strip closures at all floor edge upturned to thickness of slab to contain wet concrete. Provide closures of sufficient strength to remain in place without distortion.
- H. Install sheet closures and angle flashings to close openings between deck and walls, column, and openings.
- I. Accessories shall be fastened to supports or deck with mechanical fasteners at not over 12" o.c. and at all corners and ends.
- J. Concentrated loads and impact loads during erection and construction shall be avoided. Before the slab is poured, form deck shall be planked in all traffic areas to prevent damage to units.

3.2 CLEAN UP AND FINAL ADJUSTMENTS

- A. Touch up surface coating damage and abrasions using a paint specially formulated for use with galvanized steel. For painted deck use paint compatible with manufacturer's primer.
- B. Installation holes shall be sealed with a closure plate 2 gages thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected. Deck units that are bent, warped, or damaged in any way which would impair the strength and appearance of the deck shall be removed from site.
- C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.
- D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes, and other debris from completed installation.

END OF SECTION

SECTION 05 31 23

STEEL ROOF DECK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel roof deck and accessories.
 - 2. Frames openings up to 10 inches by 10 inches.
 - 3. Welding, fasteners, and accessories for attachment of deck.
- C. Related Sections:
 - 1. Structural Steel: Section 05 12 00
 - 2. Metal Fabrications: Section 05 50 00

1.2 SUBMITTALS

- A. Submit (1) set of hard copies and (1) electronic copy of Shop Drawings for review of general conformance to design concept in accordance with Section 01 33 00. Erection Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence of installation.
- B. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.

1.3 QUALITY ASSURANCE

- A. Metal deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) - "Specifications and Commentary for Steel Roof Deck."
- B. Welding operators shall be qualified in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to owner.

1.4 REFERENCE STANDARDS

- A. AISI - "Specification for the Design of Cold-Formed Steel Structural Members."
- B. ASTM A36 and A572 - Structural Steel.
- C. ASTM A446 - Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process, Structural (Physical) Quality.
- D. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot-Dip Process.
- E. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
- F. AWS D1.1 - Structural Welding Code.

- G. AWS D1.3 - Specification for Welding Sheet Steel in Structures.
- H. SDI - "Design Manual for Composite Decks, Form Decks and Roof Decks."
- I. AISC - Manual of Steel Construction.
- J. SDI - Diaphragm Design Manual.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials off ground with one end elevated on wood sleepers to provide drainage.
- B. Prevent damage to edges, ends and surfaces.
- C. Cut plastic wrap to encourage ventilation. Keep materials dry.
- D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Vulcraft A Division of Nucor Corporation.

2.2 MATERIALS

- A. Sheet steel shall conform to ASTM A611 Grade C, D or E for prime painted decks or from ASTM A653-94 structural quality grade 33 or higher for galvanized decks and have a minimum yield strength of 33,000 PSI.
- B. Bearing Plates and/or Angles shall be ASTM A572 steel.
- C. Welding Methods and Materials shall conform to AWS D1.1 and AWS D1.3.
- D. Steel Closure Strips, Ridge and Valley Plates, and Related Accessories shall be a minimum of 22 gage sheet steel of required profiles and sizes.
- E. Finish:
Galvanizing shall conform to the requirements of ASTM A924-94 coating Class G60.
Shop Primer shall be acrylic medium gray.
Touch-up primer shall be compatible with manufacturer's primer.
- F. Mechanical fasteners shall be Teks as manufactured by Builds, St. Charles Road, Elgin, Illinois, 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer's recommendations.

2.3 FABRICATION

- A. Steel deck shall have formed ribs of the type, finish, dimension and gage as shown on Drawings.

- B. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate sheets to lap a minimum of 2" over supports at ends. Lap joints required where roof pitch changes due to the deck support elevations.
- C. Design steel decking in accordance with SDI "Design Manual for Composite Decks, Form Decks, and Roof Decks." The maximum working stress shall not exceed 20,000 PSI. The maximum working stress shall in no case exceed the maximum yield strength of the steel divided by 1.65 but may be increased by 33% for temporary concentrated loads provided the deck thus required is not less than that required for the specific uniform load. The deflection of the Deck under design live load shall not exceed 1/240 of the span. Minimum thickness of material supplied shall be within 5% of the design thickness.
- D. Section properties used in determining stress and deflection shall be calculated in accordance with the latest edition of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks."
- E. Provide fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, watertight. Typical at all roof drains.
- F. Provide 6" closure strip where changes in deck direction occur. Closure shall be same gauge as deck.

PART 3 EXECUTION

3.1 INSTALLATION

- A. On steel support members provide 1-1/2" minimum bearing. Align and level on supports.
- B. Fasten steel deck units to structural supports using Hex washer head Tek's or arc spot welds according to manufacturers' specifications and direction layouts and as specified herein. Decks thinner than .0280 inches shall be welded using 16 ga. welding washers with a 3/8" diameter hole. Side lap connections shall be screwed.
- C. Attach ridge and valley plates and steel cant strips directly to the steel deck where shown on the Drawings to provide a finished surface for the application of insulation and roofing.
- D. Cutting of openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.
- E. Arc spot welds (puddle welds) to supports shall have a diameter of 5/8" minimum, or an elongated weld of 3/8" minimum width and 3/4" minimum length. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard "Specification for Welding Sheet Steel in Structures", AWS D1.3.
- F. Fastening of deck to supports and side laps.
 - 1. Deck ends at building perimeter: 6" o/c
 - 2. Deck end laps: 6" o/c (min.)

- 3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36" intervals whichever is smaller.
- 4. See drawings for requirements beyond these minimum requirements.
- G. At ends of decks or where changes of deck direction occur, fasten at each flute. Furnish and install adequate closures and fasten to both sides at 18" o.c.
- H. Accessories shall be fastened to supports or deck with mechanical fasteners at not over 6" o.c. and at all corners and ends.
- I. Position roof sump pans with flange bearing on top surface of deck. Screw at each deck flute.

3.2 CLEAN UP AND FINAL ADJUSTMENTS

- A. Touch up surface coating damage and abrasions using a paint compatible with primer paint and/or specially formulated for use with galvanized steel.
- B. Installation holes shall be sealed with a closure plate 2 gauges thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected. Deck units that are bent, warped, or damaged in any way which would impair the strength and appearance of the deck shall be removed from site.
- C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.
- D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes and other debris from completed installation.

END OF SECTION

SECTION 05 36 00

COMPOSITE STEEL DECK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite steel deck and accessories for forming of concrete floors.
2. Frames openings up to 10 inches by 10 inches.
3. Welding, fasteners, and accessories for attachment of deck.

B. Related Sections:

1. Cast-In-Place-Concrete: Section 03 30 00
2. Structural Steel: Section 05 12 00
3. Metal Fabrications: Section 05 50 00

1.2 SUBMITTALS:

A. Shop Drawings:

1. Submit (1) set of hard copies and (1) electronic copy of Shop Drawings for review of general conformance to design concept in accordance with Section 01 33 00.
2. Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence or installation.

B. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.

1.3 QUALITY ASSURANCE

A. Steel deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) "Specifications and Commentary for Composite Steel Form Deck."

B. Welding operators shall be qualified in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to owner.

1.4 REFERENCE STANDARDS

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A36 and A572 Specifications for Structural Steel.

C. ASTM A446 – Specification for Steel, Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

- D. ASTM A525 – Specification for Steel, Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM A611 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural Quality.
- F. AWS D1.1 - Structural Welding Code.
- G. AWS D1.3 – Structural Welding Code - Sheet Steel in Structures.
- H. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks
- I. SDI - Diaphragm Design Manual, Latest Edition
- J. AISC - Manual of Steel Construction
- K. ASCE - Specifications for the Design and Construction of Composite Slabs and Commentary on Specifications for the Design and Construction of Composite Slabs.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials off ground with one end elevated on wood sleepers to provide drainage.
- B. Prevent damage to edges, ends and surfaces.
- C. Cut plastic wrap to encourage ventilation. Keep materials dry.
- D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Vulcraft A Division of Nucor Corporation.

2.2 MATERIALS

- A. Sheet Steel:
 - 1. ASTM A 611, Grades C and D
ASTM A653-94, Structural Quality
- B. Minimum Yield Strength: $F_y = 40$ ksi.
- C. Finish: Galvanized, ASTM A653-94, G60
- D. Bearing Plate and/or Angles shall be ASTM A572 steel.
- E. Welding Materials: AWS D1.1.
- F. Steel Closure Strips, Wet Concrete Stops, Multiple Cell Headers, Cover Plates and Related Accessories shall be a minimum of 20 gage sheet steel of required profiles and sizes.

- G Mechanical fasteners shall be Teks as manufactured by Buildex, St. Charles Road, Elgin Illinois, 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer's recommendations.
- H. The deck manufacturer shall have performed or have witnessed by a Registered Engineer, a sufficient number of tests on the composite deck/slab system to have determined load/deflection characteristics and the mode of failure under uniform or symmetrically placed point loads. Based on the test data the design load capacity shall be established by either elastic flexural analysis or ultimate strength analysis based on shear bond failure or flexural failure.

2.3 FABRICATION

- A. Steel Deck shall have formed ribs of the type, finish, dimension and gage shown on Drawings.
- B. The Composite Steel deck units shall serve as a form, total positive reinforcement, and partial temperature reinforcement for the concrete slab.
- C. Deck shall be capable of supporting uniform design loads as indicated on the Drawings. Structural capacity of deck sections shall be established from section properties computed in strict accordance with the latest edition of the "Steel Deck Institute Design Manual". The maximum working stress shall not exceed the yield strength divided by 1.65. Minimum thickness of material supplied shall be within 5% of design thickness. The deflection of the deck under design live load shall not exceed 1/360 of the span.
- D. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate Deck to butt ends allowing for a maximum of 1/8" gap.
- E. Bearing lengths shall be established in accordance with the latest edition of the Steel Deck Institute's "Design Manual for Composite Decks, Form Decks and Roof Decks and shall be consistent with the deck capacity established in paragraph

PART 3 EXECUTION

3.1 INSTALLATION

- A. Deck and accessories shall be installed in accordance with the manufacturer's shop and erection drawings. Minimum bearing shall not be less than 1-1/2 inches.
- B. Fasten steel deck units to structural supports using Hex washer head Teks or arc spot welds according to manufacturer's specifications and erection layouts and as specified herein. Side lap connections shall be screwed or button punched depending on deck profile.
- C. Arc spot welds (puddle welds) to support shall have a diameter (weld nugget) of 5/8" minimum. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard "Specification for Welding Sheet Steel in Structures", AWS D1.3.
- D. Fastening of deck to supports and side laps.

1. Deck ends at building perimeter: 12" o/c (36/4 min.)
 2. Deck end laps: 12" o/c (36/4 min.)
 3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36" intervals whichever is smaller.
 4. See drawings for requirements beyond these minimum requirements.
- E. At ends of decks or where changes of deck direction occur, fasten at 18" o.c. Furnish and install adequate closures and fasten to both sides at 18" o.c.
 - F. Cutting of openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.
 - G. Install sheet steel strip closures at all floor edge upturned to thickness of slab to contain wet concrete. Provide closures of sufficient strength to remain in place during concrete placement without distortion.
 - H. Install sheet closures and angles flashing to close openings between deck and walls, columns, and openings.
 - I. Accessories shall be fastened to supports or deck with mechanical fasteners per manufacturer's recommendations.

3.2 CONSTRUCTION LOADS

- A. Composite steel floor deck units shall serve as a form to support the slab weight and construction loading of 20 psf uniform load.
- B. If heavier construction loads are required, allowable unshored spans shall be reduced accordingly by installation of temporary shoring.
- C. When required, composite steel floor deck units shall be temporarily shored in accordance with the deck manufacturers Shoring Tables. Shoring shall be designed in accordance with applicable local and state building code regulations. Shoring shall remain in place until the concrete flooring attains a minimum of 75% of the concrete design compressive strength and removal is subject to the approval of the Engineer.
- D. Concentrated loads and impact loads during erection and construction shall be avoided. Before the slab is poured, form deck shall be planked in all areas to prevent damage to units.

3.3 CLEAN UP AND FINAL ADJUSTMENTS

- A. Touch up surface coating damage and abrasions using a paint specially formulated for use with galvanized steel. For painted deck use paint compatible with manufacturer's primer.
- B. Installation holes shall be sealed with a closure plate 2 gages thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected or sealed. Deck units that are bent, warped, or damaged which would impair the strength and appearance of the deck shall be removed from site.

- C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.
- D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes, and other debris from completed installation.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: All axial or wind loaded light gage steel studs, track, joists, bridging and related accessories are as indicated on the Contract Drawings and specified herein.
- B. Related Sections:
 - Structural Steel: Section 05 12 00
 - Gypsum Wallboard: Section 09 21 16

1.2 SUBMITTALS

- A. General: Comply with Section 01 33 00
- B. Product Data: Submit copy of installation instructions for each item of lightgage framing and accessories.
- C. Shop Drawings: Submit (1) set of hard copies and (1) electronic copy of fabrication and erection drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental bracing, accessories, and details as may be required for proper installation.

1.3 QUALITY ASSURANCE

- A. Qualifications of manufacturer: products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable by the Architect.
- B. Inspection and Quality Control;
 - 1. Contractor shall provide effective full time quality control over all fabrication and erection activities.
 - 2. As directed by Architect, owner's testing agency may inspect the maintenance of a quality control program including spot checking weldments and welding procedures in accordance with A.W.S. standards.
 - 3. Inspection responsibility for quality control shall remain with contractor.
- C. Standards
 - 1. Work shall meet the requirements of the following standards.
 - a. American Iron and Steel Institute (A.I.S.I.) "Design of Cold Formed Steel Structural Members," Latest edition.
 - b. American Welding Society (A.W.S.) D.1.3, 1981 "Structural Welding Code-Sheet Steel".
 - c. American Society for Testing and Materials (A.S.T.M.)
 - d. American Institute of Steel Construction (A.I.S.C.) "Manual of Steel Construction," 9th edition.
 - e. All pertinent Federal, State and Local Codes.
 - 2. The most stringent requirements shall govern in conflicts between specified

codes and standards.

1.4 PRODUCT DELIVERY AND STORAGE:

- A. Protect metal framing units from rusting and damage. Deliver to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, location and spacing. Indicate supplemental bracing, accessories, and details as may be required for proper installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Clark Steel Framing System or approved equal.

2.2 METAL FRAMING

- A. Systems Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as indicated and as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.
- B. Material and Finishes:
 - 1. All galvanized studs and joists shall be formed from steel that corresponds to the minimum requirements of A.I.S.I. Standards.
 - 2. Structural framing members shall conform to ASTM C955, have engineering properties calculated in conformance with AISI "Specification For The Design of Cold-Formed Steel Structural Members" and have minimum properties as published by Clark Steel Framing.
 - 3. All galvanized studs, joists, track, bridging and accessories shall be formed from steel having a galvanized coating meeting the requirements of ASTM A653.
 - 4. Studs and Joists: Minimum 43 mils (18 gage), with 1.625" flange and 0.50" flange return lip. 43 mils (18 gage) units shall have yield stress (Fy)= 33ksi and 54 mils, 64 mils, 97 mils (16,14,12,10) gage units shall have a yield stress (Fy)=50 ksi.
 - 5. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
 - 6. Fasteners: (Unless noted otherwise on drawings)
 - a. Light gage metal to light gage metal: Kwik-Pro Self drilling by Hilti. No.8-18 PPH for 18 gage metal. No.10-16 PPH for 16 gage, 14 gage and 12 gage. Minimum of two screws per connection.
 - b. Light gage metal to steel: Kwik-Pro Self drilling by Hilti. No.12-24 HWH. Drill thru light gage into steel (16" o.c. maximum spacing).
 - c. Light gage to Concrete: DX Powder Actuated Fastener by Hilti. DX Fastener X-DNI Domed Head Nail. Shank .145-inch and minimum penetration of 1 1/8-inch (16" o.c. maximum spacing).
 - d. Wood to light gage: Minimum of No. 8 x 1 inch bugle head screws.
 - 7. Electrodes for welding: Comply with AWS Code and as recommended by stud manufacturer.
 - 8. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.3 FABRICATION

- A. General:
 - 1. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.
 - 2. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.
 - 3. Splices in studs shall not be permitted.
- B. Fastenings:
 - 1. Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with the manufacturer.
 - 2. Wire taping of framing components is not permitted.
 - 3. Welds shall be performed by operators qualified in accordance with section 6.0 of the American Welding Society's "Structural Welding Code-Sheet Metal" (AWS D1.3-81). (Where field welds are anticipated, we suggest that components of 18 gage thickness are not specified). All welds shall be touched up with zinc rich paint.
- C. Fabrication Tolerances:
 - 1. Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8" in 10'.
Studs shall have full bearing inside track web (1/16" max. gap), prior to stud and track attachment.

PART 3 EXECUTION

- 3.1 INSTALLATION: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, and final shop drawings.
 - A. Runner tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 16" o.c. spacing for nail or power-driven fasteners, not 12" o.c. for the other types of attachment. Provide fasteners at corners and ends of tracks.
 - B. Wall Studs: Space studs 16" o.c.
 - C. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
 - D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
 - E. Where stud system abuts structural columns or walls anchor ends or stiffeners to supporting structure.
 - F. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services,

casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the items supported.

- G. Frame wall openings larger than 2' square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure studs system wall opening frame in manner indicated.
 - H. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud; do not bridge the joint with components of the stud system.
 - I. Install horizontal bridging in stud system, spaced (vertical distance) at not more than 4 ft o.c. Weld at each intersection.
 - J. Temporary bracing shall be provided until erection is completed.
 - K. Joists: Space joist 16" o.c.
 - 1. Uniform and level joist bearing shall be provided at support by means of shims.
 - 2. Joists shall be located directly over bearing studs or a load distribution member shall be provided at the top of the bearing wall.
 - 3. Web stiffeners shall be provided at reaction points and at points of concentrated loads where indicated on the drawings.
 - 4. Joist bridging shall be provided where indicated on the drawings.
 - 5. Additional joists shall be provided under parallel partitions when the partition length exceeds one-half the joist span, also around all floor and roof openings which interrupt one or more spanning members, unless otherwise noted.
 - 6. End blocking shall be provided where joist ends are not otherwise restrained from rotation.
 - L. Erection Tolerances:
 - 1. Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.
 - 2. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16".
- 3.2 FIELD PAINTING: Touch-up shop-applied protective coating damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated metal items.
 - 1. Lintels.
 - 2. Bollards.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Welders Certificates: Required.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40.
- C. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality with galvanized coating.
- D. Welding Materials: AWS D1.1; type required for materials being welded.
- E. Shop Primer Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20.
- G. Fasteners General:
 - 1. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
 - 2. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.
 - 3. Bolts, Round Head: ANSI B-18.5
 - 4. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
 - 5. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-

2.2 BOLLARDS

- A. Bollards: Steel pipe, concrete filled, crowned cap, diameter and length as indicated on Drawings; prime paint, one coat.
- B. Concrete Fill: 3,000 psi as specified in Section 03 30 00.

- C. Anchors: Concealed type as indicated on Drawings.

2.3 FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
- B. Fabricate items with joints tightly fitted and secured. Fabricate according to approved shop drawings, and to applicable portions of AISC Specifications.
- C. Conceal welds where possible; grind exposed welds smooth and flush with adjacent finished surface. Ease exposed edges to small uniform radius.
- D. Fit and shop assemble in largest practical sections, for delivery to site.
- E. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
- F. Exposed Mechanical Fastenings: Flush countersink screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- G. Make exposed joints butt tight, flush, and hairline.
- H. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2.4 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.
- C. Prime paint interior steel items scheduled with one coat of primer.
- D. Galvanize exterior steel items and those touching exterior masonry walls to a minimum 1.25 ounces per square foot zinc coating in accordance with ASTM A123. Finish coating surface to be smooth, without irregularities, drip marks, or other roughness, ready for priming with minimal preparation required.
- E. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications.
 - 1. Interiors (SSPC Zone 1A): SSPC-SP3 Power Tool Cleaning.
 - 2. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 Paint Application Specification No. 1 for shop painting.
 - 3. Lead free, alkyd primer: Manufacturer's standard.

PART 3 EXECUTION

3.1 EXAMINATION/PREPARATION

- A. Verify that field conditions are acceptable and ready to receive work. Beginning of installation constitutes that erector accepts existing conditions.
- B. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- C. Clean and strip site primed steel items to bare metal where site welding is scheduled.
- D. Make provisions for erection loads with temporary bracing. Keep work in alignment.
- E. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Perform field welding in accordance with AWS D1.1 or ASW D1.3, depending on substrate involved.
- C. After installation, touch up field welds, scratched or damaged surfaces with primer.
- D. Install stock manufactured items in accordance with manufacturer's directions.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- F. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- G. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- H. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- I. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.3 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset from True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Welding: Inspect welds in accordance with AWS D1.1.

3.5 CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

SECTION 06 06 40

ARCHITECTURAL WALL PANELS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Decorative wall panels.

1.02 REFERENCES

- A. National Codes (IBC, UBC, SBCCI, BOCA and Life Safety)
- B. American Society for Testing and Materials (ASTM)
- C. Underwriters Laboratories (UL)

1.03 SUBMITTALS

- A. General: In accordance with Section 01 33 00 "Submittal Procedures".
- B. Product data and detailed specifications for each system component and installation accessory required, including installation methods.
- C. Shop drawings showing locations, seam locations, placement of "in-wall blocking" and or plywood skinned walls, pattern orientation, installation method, corner conditions and installation details of wall panel products.
- D. Samples for Verification Purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and thickness:
 - 1. Sample of each product specified.
- E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
- F. Maintenance data for wall system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer who has no less than 3 years experience in installation of wall panels similar in complexity to those required for this project.
- B. Product Quality Standard: To comply with AWI section 500 for flush fitting wood paneling. Quality grade to be premium.
- C. Code Compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA and Life Safety.

1.05 DELIVERY STORAGE AND HANDLING

- A. Immediately upon delivery, open crate and inspect goods prior to signing the bill of lading. This must occur regardless of any visible signs of external damage to the crating material. "Hidden" damage due to stacking of freight or mishandling the crate during the shipping process may occur. This is "Freight Damage" and not the responsibility of Interlam. If damage is found, contractor MUST sign for the freight as damaged and the driver must acknowledge that the contractor is signing for damaged freight. It is the responsibility of the contractor to file any and all freight claims resulting from this process. Interlam has no liability after the goods are shipped from Seller's address. Store materials in original, undamaged packaging in a clean, dry place out of direct sunlight and exposure to the elements. A room temperature of 40-100°F (4-38°C) should be maintained.
- B. Store materials flat.

1.06 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65-75°F (18-24°C) with maintained relative humidity levels of 25-55% for at least 48 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

PART 2 – PRODUCTS

2.01 PROJECT CONDITIONS

- A. Manufacturer:
Interlam, Corp.
391 Hickory Street
Mount Airy, NC 27030
(P) 336-786-6254 (F) 336-786-9460
<http://www.interlam-design.com>

2.02 MATERIALS

- A. Wall Panels: Interlam Art Diffusion Wall Panel SOT 002 x 2 or approved equal.
- B. Finish: Primed for paint.

2.03 WALL PANEL MOUNTING

- A. Apply a high quality construction mastic such as "Liquid Nails" or a "PL" Mastic such as "PL Premium Polyurethane" www.stickwithpl.com to the back of the panels and then pressed onto plywood wall surface. Panels must be mechanically held in place until mastic is completely set. The installer MUST insure the panels are completely flat and aligned prior to the mastic curing. Improper placement using this method will result in a permanent incorrect installation with bowing or cupping on all sides at joints.

2.04 FABRICATION

- A. General: Fabricate wall panels to comply with requirements indicated for design, dimensions, detail, finish and sizes. All based upon required field verified dimensions.

2.05 FINISHES

- A. Seal backs and edges prior to finishing faces.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.
- B. Temperature at the time of installation must be between 65-75°F (18-24°C) and be maintained for at least 48 hours after the installation to allow for proper adhesive set up.
- C. Relative humidity should be maintained within the range of 25-55%.

3.02 PREPARATION

- A. Surface Preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations and the required field verified dimensions.
- B. Butt joints tightly and apply seam filler, as recommended by manufacturer. Seam filler to be compatible with painted finish.
- C. Refer to manufacturer's instructions to achieve a smooth, monolithic appearance. Take care so that seam filler does not get on the face of the panels, but is only in the butt joint

3.04 CLEANING

- A. General: Immediately upon completion of installation, clean wall panels and accessories in accordance with manufacturer's recommended cleaning method.
- B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Finish carpentry items.
 - 2. Hardware and attachment accessories.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required for all hardware.
- C. Samples: Required to show match to prefinished wood doors.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Quality Standards, Custom Grade.
- B. Surface Burning Characteristics: Maximum 24/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

PART 2 PRODUCTS

2.1 COMPONENTS – WOOD VENEERED MILLWORK

- A. Exposed and Semi-Exposed Surfaces: AWI Grade Custom.
 - 1. Species of Wood: Walnut.
 - 2. Cut or Slicing of Wood: Plain sliced.
 - 3. Matching of Individual Leaves to Each Other: Book matching.
- B. Fully Concealed Surfaces: MDF. Particleboard is NOT acceptable.

2.2 COMPONENTS – LAMINATE CLAD MILLWORK

- A. Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces.

1. Faces – Break Room: Wilsonart, Satin Stainless 4830K-18
2. Faces – Work/Copy: Formica, Blackened Legno 8848-58
3. Countertops – Autotellers, Work/Copy: Wilsonart, Crisp Linen 4942-38.

2.3 ACCESSORIES

- A. Concealed Joint Fasteners: Threaded steel.
- B. Wood Filler: Tinted to match surface finish color.
- C. Hardware:
 1. Hinges: Concealed style, nickel-plated steel finish.
 2. Pulls: Hardware Resources, Elements, Naples, #154SS; satin nickel finish.
 - a. Drawers: Install horizontally.
 - b. Doors: Install vertically.
 3. Latches: Concealed style, nickel-plated steel finish.
 4. Grommets: EDP with 2-1/2" hole; satin chrome finish. Mockett & Co. (800.523.1269).
 - a. Quantity: 15
 5. Shelf Standards: Recessed style, such as KV #255, zinc plated steel finish.
 6. Shelf Brackets: KV #256, zinc plated steel finish.
 7. Drawer Glides: Heavy duty, steel ball bearing, 100 lb. minimum, full extension.
 8. Waste Bin Glide: Hafele, Euro Cargo 45; pull-out, door mounted, 110 lb. capacity, with telescopic over extension ball bearing slides.

2.4 FABRICATION

- A. Fabricate to AWI Custom standards, unless noted otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install work in accordance with AWI Custom quality standard, unless noted otherwise.
- B. Set and secure materials and components in place, plumb and level.
- C. Cover exposed edges of wood veneered millwork with a 3/8 inch thick hardwood edging, where 1 x 2's are not shown. Taped edges are permissible only at edges of reveals.
- D. Install hardware and adjust for smooth operation.
- E. Cut holes in countertops and install grommets in locations determined by Owner.
- F. Preparation for Site Finishing (Wood Veneered Millwork):
 1. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
 2. Site Finishing: Refer to Section 09 90 00.

END OF SECTION

SOLID SURFACING FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Cast plastic fabrications.
1. Lavatory tops with undermount bowls.
 2. Millwork counter tops with undermount sinks and backsplashes.

1.2 PERFORMANCE REQUIREMENTS

- A. Performance/Design Criteria:

Property	Requirement Procedure (min or max)	Test
1. Solid Surface Based Products:		
a. Tensile Strength	6000 psi min	ASTM D638
b. Tensile Modulus	1.5×10^6 psi min	ASTM D 638
c. Tensile Elongation	0.4% min	ASTM D638
d. Flexural Strength	10,000 psi min	ASTM D790
e. Flexural Modulus	1.2×10^6 psi min	ASTM D790
f. Hardness	>85 Rockwell "M" scale	ASTM D785
g. Thermal Expansion	2.2×10^{-5} in/in/°F	ASTM E228
h. Fungi and Bacteria	Does not support	ASTM G21 & G22
i. Microbial Resistance	Highly resistant to mold	UL 2824
j. Ball Impact	No fracture – ½ lb. ball; 6 mm slab – 36" drop 12 mm slab – 144" drop	NEMA LD 3, Method 3.8
k. Weatherability	$\Delta E^*94 < 5$ in 1,000 hrs	ASTM G155
l. Flammability		ASTM E84, NFPA 255, BB & UL 723
m. Flame Spread	<25	
n. Smoke Developed	<25	
o. Class	A	NFPA 101, Life Safety Code

1.3 SUBMITTALS

- A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
1. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 2. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

- B. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
- C. Provide copy of fabricator's certification from manufacturer.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
 - 2. Include in project closeout documents.

1.4 QUALIFICATIONS

- A. Fabricator: Minimum 5 years experience in the application of products, systems and assemblies specified, with the approval and training by the manufacturer.

1.5 WARRANTY

- A. Furnish ten year manufacturer warranty.

1.6 MAINTENANCE

- A. Furnish two containers of polishing cream.

PART 2 PRODUCTS

2.1 PLASTIC FABRICATIONS

- A. Manufacturer/Style/Color: Formica, White Renew 748.

2.2 COMPONENTS

- A. Solid Polymer Components:
 - 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6 having minimum physical and performance properties specified.
 - 2. Superficial damage to a depth of 0.010 inch (0.25 mm) shall be repairable by sanding and/or polishing.
 - 3. Flammability: UL 723; Class 1 and A.

2.3 ACCESSORIES

- A. Polishing Cream: Compatible polishing cream to achieve specified sheen to gel coat.
- B. Core Framing: As shown on Drawings.
- C. Adhesive: ASTM C920; one component silicone, approved by manufacturer, to create inconspicuous, nonporous joints.
- D. Sealant: Manufacturer's standard mildew-resistant FDA-compliant, NSF 51-compliant (food zone – any type), UL-listed silicone sealant in colors matching components.

2.4 FABRICATION

- A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings as indicated on Drawings.
- B. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
- C. Ensure no blistering, whitening and cracking of components during forming.
- D. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings.
- E. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint. Reinforcing strip of solid polymer material is not required when using DuPont™ Joint Adhesive 2.0
- F. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
- G. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
- H. Finish: Ensure surfaces have uniform finish:
 - 1. Semi-gloss, with a 60° gloss rating of 25 - 50.
- I. Fabrication Tolerances:
 - 1. Variation in Component Size: $\pm 1/8"$.
 - 2. Location of Openings: $\pm 1/8"$ from indicated location.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify actual site dimensions and location of adjacent materials prior to commencing work.
- C. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within $1/8"$ in 10' - 0".
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- B. Provide product in the largest pieces available. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Exposed joints/seams shall not be allowed.
- C. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
- D. Cut and finish component edges with clean, sharp returns. Rout radii and contours to template.
- E. Anchor securely to base cabinets or other supports.
- F. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
- G. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- H. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- I. Repair or replace damaged work which cannot be repaired to Architect's satisfaction.
- J. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.
- K. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-coordinated joint adhesive.
- L. Coordinate connections of plumbing fixtures.

3.3 SITE QUALITY CONTROL

- A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".
- B. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.4 CLEANING AND PROTECTION

- A. Keep components and hands clean during installation.
- B. Remove adhesives, sealants and other stains.

END OF SECTION

QUARTZ SURFACING FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes horizontal countertops, splashes and bullnoses.

1.2 DEFINITION

- A. Homogenous mixture containing 93% pure quartz with additions of high performance polyester resin pigments and special effects.

1.3 SYSTEM DESCRIPTION

- A. Performance characteristics:

Property	Typical Result	Test
Compressive Strength	24,750 psi	ASTM C170
Modulus of Rupture	6,800	ASTM C99
Bond Strength	205 psi	ASTM C482
Thermal Shock	passes 5 cycles	ASTM 484
Stain Resistance	Unaffected	ANSI Z124.6
Moisture Absorption	0.02%	ASTM C97
Moisture Expansion	<0.01	ASTM C370
Abrasion Resistance	223	ASTM C501
Coefficient of Thermal Expansion	$1.2 \times 10^{-5}/F$	ASTM C531
Breaking Strength of Tile	3661 lbf	ASTM 648
Resistance to Freeze Thaw Cycling	Unaffected 15 cycles	ASTM C1028
Coefficient of Friction Pull Method	0.75 avg. dry/0.55 avg. wet	ASTM C1028
Surface Burning Characteristics 17		ASTM E84
Smoke Density	Flaming 196, Non-flaming 69	ASTM E662

1.4 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings:
1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
- C. Samples:
1. For each type of product indicated.
 - a. Submit minimum 6-inch by 6-inch sample in specified gloss.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
 2. Approved samples will be retained as a standard for work.

- D. Fabricator/Installer Qualifications:
 - 1. Provide copy of certification number.
- E. Maintenance Data:
 - 1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
 - 2. Include in project closeout documents.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- B. Fabricator/installer Qualifications:
 - 1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 - 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 - 1. Warranty shall provide material and labor to repair or replace defective materials.
 - 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
 - 3. Warranty shall be transferable to subsequent owner for remainder of warranty period.
- B. Manufacturer's warranty period:
 - 1. Ten years from date of substantial completion.

1.8 MAINTENANCE

- A. Provide maintenance requirements as specified by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURER/COLOR

- A. Teller Pods:
 - 1. Manufacturer: Cambria.
 - 2. Pattern/Color: Newport.
- B. Staff Lounge: Manufacturer:
 - 1. Manufacturer: Corian
 - 2. Pattern/Color: Carbon Cement

2.2 MATERIALS

- A. Quartz Components: Homogenous mixture containing 93% pure quartz with additions of high performance polyester resin, pigments and special effects.
- B. Thicknesses: 2 cm with 4 cm edge.
- C. Edge treatment: As indicated on Drawings.
- D. Finish: High gloss.

2.3 ACCESSORIES

- A. Mounting Adhesive: Structural grade "50 year" silicone or epoxy adhesive.
- B. Surface Adhesive: Epoxy or polyester.
- C. Adhesive Manufacturers:
 - 1. Cambria
 - 2. Akemi North America
 - 3. Bonstone Material Corp.
 - 4. Tenax USA
- D. Joint Sealant: Clear sealant of type recommended by manufacturer for application and use.
 - 1. Manufacturers:
 - a. Dow Corning
 - b. GE Sealants
- E. Solvents: Denatured alcohol for cleaning to assure adhesion of adhesives and sealants.

2.4 FABRICATION

- A. Layout surfaces to minimize joints and avoid L-shaped pieces of quartz surfacing. Layout and fabricate with hairline joints.
- B. Inspect materials for defects prior to fabrication.
- C. Cut and polish with water cooled powered tools.
- D. Cutouts to have minimum of 3/8 inch radius.

- E. Where edges of cutouts will be exposed in finished work, polish edges.
- F. Laminate layers of quartz surfacing as required to create built up edges following procedures recommended by the manufacturer.
- G. Fabrication must be by a certified fabricator, certified in writing by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify dimensions by field measurements prior to installation.
- C. Verify that substrates supporting quartz surfaces are plumb, level and flat to within 1/8 inch in 10 feet and that all necessary supports and blocking are in place.
- D. Clean surfaces prior to installation. Protect finished surfaces from scratches. Apply masking where necessary. Take necessary precautions to prevent dirt, grit, dust and debris from other trades from contacting the surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation must be by a certified installer, certified in writing by the manufacturer.
- B. Install materials in accordance with manufacturer's instructions and approved shop drawings.
- C. Position materials to verify the correct size. If size adjustments or additional fabrication is necessary, use water cooled tools. Protect jobsite and surface from dust and water.
- D. Allow gaps for expansion of not less than 1/8 inch per ten feet when installed between walls or other fixed structure.
- E. Clean substrate. Remove loose and foreign matter which may interfere with adhesion. Clean backside and joints with denatured alcohol. Apply continuous bead of mounting adhesive around perimeter of structural substrate and supports on horizontal surface. Apply continuous bead of mounting adhesive around perimeter of vertical surfaces. In addition, apply ¼ inch mounting adhesive bead every 8 inches on vertical center.
- F. Install quartz surfacing plumb, level, square and flat to within 1/8 inch in ten feet, non-cumulative. Align adjacent pieces in same plane.
- G. Joints:
 - 1. Joints between Adjacent Pieces of Quartz Surfacing:

- a. Joints to be flush, tight fitting, level and neat.
 - b. Securely join adjacent pieces with two part acrylic adhesive.
 - c. Fill joints level to polished surface.
 - d. Secure adjacent quartz surfaces with vacuum clamps until adhesive hardens.
- 2. Joints Between Quartz Surface and Backsplash: Seal joints with silicone sealant.

3.3 REPAIR

- A. Replace or repair damaged material to like new condition.

3.4 CLEANING AND PROTECTION

- A. Remove masking, excessive adhesive and sealants. Clean exposed surfaces with denatured alcohol.
- B. Protect installed fabrications with non-staining sheet coverings.

END OF SECTION

SECTION 07 10 00

WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Waterproofing system at elevator pit.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit details of product description, tests performed, limitations to coating, and chemical properties including percentage of solids.
- C. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention, and cautionary procedures required during application.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect coating liquid from freezing.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not apply coating when temperature is lower than 40 degrees F or higher than 100 degrees F.
- C. Do not apply coating when wind velocity exceeds manufacturer recommendations.

1.6 WARRANTY

- A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for water repellents.

PART 2 PRODUCTS

2.1 WATERPROOFING – ELEVATOR PIT

- A. Manufacturer: W. R Meadows, or approved equal.
- B. Waterproofing Membrane: ASTM E1993; PMPC (Premoulded Membrane Vapor Seal with Plasmatic Core); 7 ply weather-coated, permanently bonded, semi-flexible waterproofing membrane. It is composed of a plasmatic core, suspended mid-point between two layers of a homogeneous, bituminous material, then sealed under heat and pressure between liners of asphalt-impregnated felt and a glass-mat liner. An asphalt weather coat is applied to the glass-mat liner and covered with a polyethylene anti-stick sheet.
 - 1. Permeance: 0.0011 perms when tested in accordance with ASTM F1249.
 - 2. Tensile Strength: 156 lb/inch when tested in accordance with ASTM E154.
 - 3. Puncture Resistance: 149 when tested in accordance with ASTM E154.
- C. Accessories:
 - 1. Pointing Mastic: Mel Prime; used for sealing top horizontal terminations or slab protrusions.
 - 2. Joint Tape: PMPC tape; self-adhering, reinforced tape of polymeric membrane with plasmatic core, that requires no additional adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coatings.
- A. Do not apply waterproofing to damp, frozen, dirty, or dusty surfaces.

3.2 PREPARATION

- A. Delay Work until masonry mortar substrate is cured minimum of 60 days.
- B. Repair spalled areas at elevator pit to receive waterproofing. Fill all voids and remove all sharp protrusions.

3.3 APPLICATION

- A. Apply Work in accordance with manufacturers' instructions.
- B. Butt sheets together tightly. Remove the polyfilm from the joint area and center the joint tape over the butt joints and roll down with pressure for a positive seal.
 - 1. Seal all protrusions through the concrete slab, such as sewer pipes, water pipes, and utility inlets, with a positive seal between the protrusion and PMPC. Place a collar of PMPC at least 12" (31 cm) larger than the protrusion around the protrusion.

2. Seal in place with PMPC TAPE and point around the protrusion with pointing mastic.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution Requirements: Protecting installed construction.
- B. Protect adjacent surfaces not scheduled to receive coating.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Board thermal insulation at perimeter foundation wall.
 - 2. Batt thermal insulation in exterior wall construction.
- B. Related Sections:
 - 1. Section 07 21 20: Exterior Insulated Sheathing
 - 2. Section 09 26 00: Gypsum Board Systems for sound batts.

1.2 SUBMITTALS

- A. Product Data: Required.

1.3 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 285.
- B. Apply label from agency approved by authority having jurisdiction to identify each insulation material.

PART 2 PRODUCTS

2.1 BUILDING INSULATION

- A. Extruded Polystyrene Insulation: ASTM C578 Type VI, cellular type.
 - 1. Foundation: Dow Styrofoam Square Edge
 - a. Thermal Resistance: R of 10.
 - b. Thickness: 2 inches at foundation.
 - c. Compressive Strength: Minimum 25 psi.
 - d. Edges: Square.
 - e. ASTM C578 Type IV: Meets IBC/IRC requirements for foam plastic insulation.
- B. Batt Insulation: ASTM C665, preformed mineral fiber.
 - 1. Thermal Resistance: **R of 19.**
 - 2. Facing: Kraft paper.

2.2 ACCESSORIES

- A. Adhesive: Type recommended by insulation manufacturer for application.
- B. Tape: Self-adhering type.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Foundation Perimeter - Board Insulation:
 - 1. Adhere polyethylene sheet over substrate joints.
 - 2. Apply adhesive and install boards on foundation perimeter.
 - 3. Place protective boards over exposed insulation surface.
- B. Batt Insulation:
 - 1. Install in exterior walls spaces without gaps or voids.
 - 2. Attach flanges of facing to framing members.

END OF SECTION

SECTION 07 21 20

EXTERIOR INSULATED SHEATHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Exterior insulated wall sheathing with integral water-resistive barrier and air barrier.
- B. Related Sections:
 - 1. Section 07 21 00: Thermal Insulation
 - 2. Section 09 21 16: Gypsum Board Assemblies (for interior insulation)

1.2 SUBMITTALS

- A. Product Data: For each type of product specified.

1.3 CLOSEOUT SUBMITTALS

- A. Warranty: Executed copy of manufacturer special warranties.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.
- B. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.
- C. Flashing and Sealant: Surface and ambient temperatures should be 35°F and rising and below 120°F during application. LIQUIDARMOR™ -CM Flashing and tolerates rain if adequate skin forms before rain exposure. Exact time varies depending on temperature and humidity conditions. In low temperature, high humidity (> 50% R.H.) applications, allow LIQUIDARMOR™- CM to cure for at least 24 hours. However, do not apply to surfaces with standing water or frost.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard 15 year warranty.

PART 2 PRODUCTS

2.1 SHEATHING - MANUFACTURER

- A. Basis-of-Design Product: DOW, Thermax XArmor.
- B. Substitutions: Refer to Section 01 60 00.
- C. Description: Rigid board insulation consisting of glass-fiber-infused polyisocyanurate foam core laminate between 1.0 mil smooth, reflective aluminum facers on interior and 4.0 mil embossed, acrylic-coated aluminum facer on the exterior.

1. Water Vapor Permeance: ASTM E96 - <0.04
 2. Water Absorption: ASTM C209 - 0.1.
 3. Water Penetration: : Tested in accordance with ASTM E331, with minimum pressure differential of 6.24 psf (300 Pa) for at least two hour test duration without any uncontrolled water penetration.
 4. Air Infiltration: ASTM E2357 at a test pressure of 6.24 psf; less than 0.04 cfm / sq. ft.
 5. Flexural Strength: ASTM C203; 55 psi min.
 6. Flame Spread/Smoke Development Ratings: 25/<450.
 7. R Value: 6.5.
- D. Size:
1. Sheet Size: 4' x 8'.
 2. Thickness: 1 inch.
- E. Flashing and Sealant: LiquidArmor.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine framing spacing and alignment to determine if work is ready to receive insulation. Proceed with work once conditions meet requirements.
- B. Treat any gaps in Thermax sheathing greater than ¼" wide with insulating foam (GREAT STUFF PRO) or caulk.

3.2 INSTALLATION

- A. Install panels in accordance with manufacturer's written instructions, and requirements of authorities having jurisdiction.
- B. Coordinate installation with flashing and joint sealant sequencing and installation to provide complete, continuous air- and moisture- barrier.
- C. Do not compress insulation to fit into spaces.
- D. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- E. Keep insulation minimum 3" from heat emitting devices such as recessed light fixtures, and minimum 2" from sidewalls of chimneys and vents.
- F. Apply tape at all panel seams, penetrations, gaps, and cracks, to form continuous weathertight surface. Apply according to manufacturer's written instructions.

END OF SECTION

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work described in this section includes concealed fastener, lap-seam pre-formed metal wall panel system complete with non-structural metal framing, perimeter and penetration flashing and closures.
- B. Related Work:
 - 1. Structural steel.
 - 2. Steel girts and furring.
 - 3. Rough carpentry.
 - 4. Flashing and sheet metal.
 - 5. Insulated sheathing and weather barrier.
 - 6. Sealants.

1.2 DEFINITIONS

- A. American Architectural Manufacturer Association (AAMA):
 - 1. AAMA 621-96: Voluntary/Standard Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
- B. American Iron and Steel Institute (AISI):
 - 1. S100-07: 2007 Edition of the North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. American Society for Testing and Materials (ASTM):
 - 1. A653-03: Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A755-03: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. A792-03: Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. B209-02a: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual, 6th edition.
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. Metal Finishes Manual for Architectural and Metal Products

1.3 DESIGN AND PERFORMANCE CRITERIA

- A. General Performance: Metal wall panel assemblies shall be furnished and installed without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

- A. Shop Drawings: Show wall panel system with flashings and accessories in elevation, sections, and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work. Shop drawings to be prepared by metal wall panel manufacturer. Include elevations of every wall.
- B. Warranty: Provide unexecuted specimen warranty documents for each warranty as required in specification article 1.9.
- C. Samples.
 - 1. Submit sample of panel section, at least 6" x 6" showing seam profile, and also a sample of color selected.
 - 2. Submit sample field applied sealants and all other system components.

1.5 QUALITY CRITERIA/INSTALLER QUALIFICATIONS

- A. Engage an experienced metal wall panel contractor (erector) to install wall panel system who has a minimum of three (3) years experience specializing in the installation of metal wall systems.
- B. Contractor must be certified by manufacturer specified as a supplier of the metal wall system and obtain written certification from manufacturer that installer is approved for installation of the specified system.
- C. Successful contractor must obtain all components of wall system from a single manufacturer. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.
- D. Fabricator/Installer shall submit work experience and evidence of adequate financial responsibility. Architect reserves the right to inspect fabrication facilities in determining qualifications.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspect materials upon delivery.
- B. Handle materials to prevent damage.
- C. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from any debris.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal wall panels by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate sizes and locations of windows, doors, and wall penetrations with actual equipment provided.
- B. Coordinate metal wall panels with exterior insulated sheathing, rain drainage work, flashing, trim, and construction of other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.9 WARRANTIES

- A. Endorse and forward to owner the following warranties:
 - 1. Manufacturer's standard 20 year finish warranty covering checking, crazing, peeling, chalking, fading, and adhesion of the prepainted sheet metal materials.
 - 2. Installer's 3 year warranty covering wall panel system installation and watertightness.
- B. Warranties shall commence on date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Manufacturer/Style: Imetco Element Series, or approved equal.
- B. Painted, Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - 1. 22 gauge, Zinc-Coated (Galvanized) Steel Sheet, as per ASTM A653: G90 coating designation; structural quality, grade 40 ksi.
 - 2. Texture: Smooth surface.
 - 3. Exposed Coil-Coated Finish:
 - a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers' approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.
 - c. Colors:
 - 1) Color #1: Imetco, Champagne, or approved equal.
 - 2) Color #2: Imetco, Blue Sapphire, or approved equal.
 - 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
 - 5. Size: 18 x 36" with 3/4" reveal; standard profile.
- C. Panel Sealants:
 - 1. Sealant Tape: Non-curing, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1-inch-wide and 1/16-inch thick.

2. Exposed Sealant: ASTM C 920; elastomeric tripolymer, polyurethane, or other advanced polymer sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Concealed Sealant: ASTM C 1311: Butyl-Based, Solvent-Release, One-Part Sealant.

2.2 FIELD-INSTALLED INSULATED SHEATHING

- A. Refer to Section 07 21 20 - Exterior Insulated Sheathing.

2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653, G90 hot-dip galvanized.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.054-inch (16 gauge) nominal thickness.
- C. Base or Sill Channels: 0.068-inch (14 gauge) nominal thickness.
- D. Horizontal Hat-Shaped, Vented, Rigid Furring Channels:
 1. Nominal Thickness: 0.063-inch
 2. Depth: 1 inch.
 3. Top Flange: 2-1/2 inches nominal.
 4. Bottom Flange: 1-3/8 inches nominal with 1/4" holes punched at 8" o.c. in each flange.
 5. Free Air Flow: The vented girt shall not restrict chimney effect air convection in the vertical direction. The vented girt webs shall have slotted holes providing for 31% free air flow and weep holes for water drainage.
 6. Drainage: Web segments of vented girt shall be formed such that when installed in the horizontal orientation the web segments are inclined at least 20 degrees from horizontal to promote drainage and prevent retention of standing water.
- E. Fasteners for Miscellaneous Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 CONCEALED CLIP – REVEAL JOINT METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by interlocking seams and incorporating concealed fasteners.
- B. Concealed clip, longitudinal lap-seam panel with labyrinth-joint and reveal on four sides.
 1. Panel shall be IMETCO ELEMENT Wall system as manufactured by Innovative Metals Company, Inc. (IMETCO); Norcross, Georgia; telephone 1-800-646-3826.
 2. Material: Aluminum sheet, 0.063 inch thick. See 2.1 for finishes and color selection.
 3. Characteristics.
 - a. Fabrication: Panels shall be factory formed from specified metal.
 - b. The standard profile shall be flat pans with reveal joints on all four sides.
 - c. Panel orientation: Horizontal.
 - d. Configuration (Horizontal): Panel shall be 18-inches nominal by 36 long nominal, with interlocking seams incorporating concealed fasteners.
 - e. Panel Depth (Concealed Leg Height): 1 1/4 inch (32 mm), nominal.

- f. Reveal Joint: Panel seams shall join such that adjacent panels form vertical and horizontal reveal joints 3/4-inch wide.
 - 1) Horizontal reveal joints shall be aligned from panel to panel, as shown on drawings.
 - 2) Vertical reveal joints shall be staggered from panel to panel, as shown on drawings.
- g. End Folds: Panel ends shall be factory notched by automatic mechanical press equipment to form end tabs of 1 inch (25 mm) nominal length. The end tabs shall be factory folded 90 degrees to produce a “box pan” effect and allow for reveal joints on all four sides of the panel. Vertically oriented panels to have a double end fold.
- h. Backer Board: Factory adhere a 5/8-inch- (15-mm-) thick extruded polystyrene foam backer board in the panel cavity for improved panel flatness.
- i. Parapet Coping: Refer to drawings.

MISCELLANEOUS MATERIALS

2.5

- A. Concealed Fasteners: Corrosion resistant steel screws, #10 minimum diameter x length appropriate for substrate, hex washer head or pancake head. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.
- B. Exposed Fasteners: 3xx series stainless steel screws (cadmium or zinc coatings are not acceptable) with neoprene sealing washer, or 1/8-inch diameter stainless steel rivets.

ACCESSORIES

2.6

- A. Wall Panel Accessories: Provide components approved by panel manufacturer and as required for a complete metal wall panel assembly including trim, corner units, closures, clips, flashings, sealants, gaskets, fillers, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - 1. Anchor Clips: Clips shall be 18 gauge galvanized steel designed to allow thermal movement of the panel in each direction along the longitudinal dimension.
 - 2. Gutter Splice at Vertical Reveal: At the vertical reveal joint, a sheet metal gutter splice shall be provided in the same material type and finish as the metal cladding panels for all visible space at the reveal joint. Gutter splice material thickness shall be as recommended by manufacturer based on panel height.
 - 3. Corner Units: Provide factory fabricated mitered corner units of the same profile(s) as specified. Corner units shall be furnished for outside and inside corner conditions.
 - 4. Ventilation strips shall be provided at top of wall panels, window sills, and transitions between metal panels and other exterior finish materials to allow for air exhaust at top of wall cavity. Vent strips shall be internally baffled to prevent wind driven rain from freely entering the wall cavity.
 - 5. Ventilation strips shall be provided at base of wall panels, window head, and transitions between metal panels and other exterior finish materials to allow for air intake and water weep holes at bottom of wall cavity.
- B. Flashing and Trim: Formed from same material and gauge as wall panels, prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, head, sill, corners, jambs, framed openings, fascia, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.
- C. Provide transitions, trim and corners, jambs and miscellaneous terminations.

2.7 FABRICATION

- A. Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Form flashing components from full single width sheet in minimum 10'-0" sections. Provide mitered trim corners, joined using closed end pop rivets and butyl-based, solvent released one-part sealant.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Sealed Joints: Form nonexpanding but movable joints in metal to accommodate butyl-based sealant to comply with SMACNA standards.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary wall framing to verify that girts, studs, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer.

- C. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
- D. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Establish straight, side and crosswise benchmarks.
- C. Use proper size and length fastener for strength requirements. A low profile fastener head of approximately 1/8 inch maximum is allowable beneath the panel.
- D. All walls shall be checked for square and straightness. Inside and outside corners may not be plumb; set a true line for the corner flashing with string line.
- E. Measure the wall lengthwise to confirm panel lengths and verify clearances for thermal movement.

3.3 METAL SUBFRAMING INSTALLATION

- A. Install metal subframing directly over continuous thermal insulation. Metal subframing shall attach to the structural wall elements with screw fasteners. Metal subframing shall be spaced as necessary to accommodate the required clip spacing for the metal cladding panels.
- B. Attachments shall be as recommended by the metal claddings system manufacturer's approved shop drawings.

3.4 METAL WALL PANEL INSTALLATION

- A. All details will be shown on in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.

- B. Directly over the completed wall substrate, fasten the top flange of the panel to the metal subframing using panel clips. All panels clips will be fastened into the metal subframing as indicated on the metal cladding panel manufacturer's approved shop drawings.
- C. Installation of Wall Panels: Wall panels can be installed by starting from one end and working towards the opposite end (vertical orientation), or from the bottom of wall working towards the top of the wall (horizontal orientation).
- D. Metal wall panels and trim must be installed only in accordance with the manufacturer's recommendation for acceptable temperature range.
- E. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- F. Limit exposed fasteners to extent indicated on contract drawings.
- G. Seal laps and joints in accordance with wall panel system manufacturer's product data.
- H. Coordinate flashing and sheet metal work to provide weathertight conditions at wall terminations. Fabricate and install in accordance with standards of SMACNA Manual.
- I. Provide for temperature expansion/contraction movement of panels at wall penetrations and wall mounted equipment in accordance with system manufacturer's product data and design calculations.
- J. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.
- K. At joints in linear sheet metal items, set sheet metal items in two ¼-inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
- L. Remove damaged work and replace with new, undamaged components.
- M. Touch up exposed fasteners using paint furnished by the panel manufacturer and matching exposed panel surface finish.
- N. Clean exposed surfaces of wall panels and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet at location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal wall panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 42 43

COMPOSITE METAL PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Composite metal panels with mounting system as part of wall cladding system.
 - 2. Related accessories.

1.2 SUBMITTALS

- A. Comply with Section 01 33 00, unless otherwise indicated.
 - 1. Product Data: Manufacturer's specifications, technical data, and test results.
 - 2. Shop Drawings: Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, trim, flashing and accessories.
 - 3. Panel System Assembly: Two samples of each type of assembly, 12 inches x 12 inches minimum.
 - 4. Two samples of each color or finish selected, 3 inches x 4 inches minimum.

1.3 QUALITY ASSURANCE

- A. Composite panel manufacturer shall have a minimum of 10 years of experience in the manufacturing of this product.
- B. Fabricator and installer shall be acceptable to Composite Panel manufacturer.
 - 1. Approved Fabricators:
 - a. Architectural Fabricators Company, Inc., Bartlesville, OK phone 918-331-0393
 - b. Elward Systems Corporation, Lakewood, CO, 1-800-933-5339
 - 2. Submit substitution requests in accordance with Section 01 60 00.
- C. Fabricator and installer shall have a minimum of 10 years experience of metal panel fabrication/installation work similar in scope and size to this project.
- D. Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.
- E. Shop drawings shall show the preferred joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by ASTM E 331.
- F. Maximum deviation from vertical and horizontal alignment of erected panels: 1/4" in 20'0" non-accumulative.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver products in packaging with legible fabricators identification.
- B. Storage and Protection: Comply with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 COMPOSITE METAL PANELS

- A. Manufacturers:
 - 1. Alcoa Cladding Systems (aka Alucobond aluminum composite material manufactured by Alusuisse Composites).
 - 2. Alpolc by Mitsubishi Kasei America, Inc.
 - 3. Substitutions: Not permitted.
- B. Composite Aluminum Panels: Two sheets of aluminum sandwiching a core of extruded thermoplastic formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation materials. Products laminated sheet by sheet in a batch process using glues or adhesives between materials will not be accepted.
 - 1. Panel Total Thickness: 0.157 (4mm).
 - 2. Aluminum Face Sheet Thickness: 0.020 inch.
 - 3. Bond Integrity: Per ASTM D1781-76 and ASTM C481 Cycle B, shall be a minimum of 40 in-lb/in. (Peel strength.)
- C. Exterior Finish: Coating shall be Colorweld 300, a two-coat fluoropolymer coating utilizing 70% Kynar 500 resins.
 - 1. Color: Alucobond, Champagne Metallic.
 - 2. Coating shall be factory applied on a continuous process paint line. Coating shall consist of a 0.2 mil (approximate) prime coat and a 0.8 mil (approximate) finish coat containing 70% Kynar resins.
 - 3. Pencil Hardness-ASTM D3363-74; HB-H minimum (Eagle Turquoise).
 - 4. Impact Adhesion-ASTM D2794-84; Coating shall show no cracking and no loss of adhesion.
 - 5. Cure Test-NCCA 11-18; Coating shall withstand 50+ double rubs of MEK soaked cloth.
 - 6. Humidity Resistance-ASTM D2247-87; Coating shall show no blisters after 3000 hours of 100% humidity at 95°F.
 - 7. Salt Spray Resistance-ASTM B117-85; After 300 hours of exposure to 5% salt fog, at 95°F, scored sample shall show none or few #8 blisters, and less than 1/8" average creepage from scribe.
 - 8. Weatherometer Test-ASTM D822-86/G23-88; Coating shall show no cracking, peeling, blistering or loss of adhesion after 2000 hours.
 - a. Chalking Resistance-ASTM D659-86; No chalking greater than #8 after 10 years Florida exposure at 45°S
 - b. Color Change-ASTM D2244-74; Color change shall not exceed 5 NBS units after 10 years Florida exposure at 45°S.
 - c. After 5000 hours in Atlas Weatherometer coating shall show no objectionable chalking or color change.
 - 9. Abrasion Resistance-ASTM D968-81; Coating shall resist 65±15 liters/mil minimum of falling sand.

2.2 PANEL FABRICATION

- A. Shop fabricate metal panels and trim to conform to profiles indicated.
- B. Panel Tolerances:
 - 1. Panel Bow: Not to exceed 0.8% of panel overall dimension in width or length.
 - 2. Panel Dimensions: Panel dimensions shall be such that there will be an allowance for field adjustment and thermal movement.
 - 3. Panel lines, breaks and curves shall be sharp, smooth and free of warps or buckles.
- C. System Characteristics:
 - 1. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards as follows:
 - a. Rout and Return Wet: System must provide a wet seal (caulked) reveal joint as detailed on drawings. The sealant shall be compatible with panel material with foamed type backer rod as indicated on architectural drawings.
 - 2. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.
 - 3. Fabricate panel system so that no restraints can be placed on the panel that might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.
 - 4. The finish side of the panel shall have a removable plastic film applied prior to fabrication which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

2.3 ACCESSORIES

- A. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.
- B. Fabricate flashing materials from 0.030" minimum thickness sheet painted to match the adjacent panel system where exposed. Provide a lap strip under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.
- C. Any necessary exposed fasteners shall be self-tapping 300 series stainless steel.
- D. All self-drilling fasteners shall be protected with a corrosion resistant finish.

PART 3 EXECUTION

3.1 INSPECTION

- A. Panel substrate shall be level and plumb.
- B. Panel substructure shall be structurally sound as determined by Architect/Engineer.

- C. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances.

3.2 INSTALLATION

- A. Erect panels level and plumb, in proper alignment and relation to substructure framing and established lines.
- B. Panels shall be erected in accordance with an approved set of shop drawings.
- C. Panel anchorage shall be structurally sound and per engineering recommendations.
- D. Conform to panel fabricator's instructions for installation of concealed fasteners.
- E. Where aluminum panels come in contact with dissimilar materials, a bituminous paint or caulking tape shall be installed to insulate between the dissimilar materials. Factory applied protective paint or G-90 galvanized steel is considered adequate insulation.
- F. Do not install component parts that are observed to be defective, including; warped, bowed, dented, abraded, and broken members.
- G. Wet seal joints – coordinate with Section 07 90 00.

3.3 ADJUSTING AND CLEANING

- A. Replace panels that have received irreparable damage.
- B. Repair panels with minor damage.
- C. Remove strippable film coating as soon as possible after surrounding material has been installed. (Glass above should typically be washed prior to removing strippable film below.)

END OF SECTION

SECTION 07 61 00

METAL ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes galvanized sheet steel roofing, associated flashings, and underlayment.
- B. Related Sections:
 - 1. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Product Data: Submit data on metal types, finishes, and characteristics.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise noted.

1.4 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal roof installations with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials causing discoloration or staining.

1.6 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for sheet metal roofing.

PART 2 PRODUCTS

2.1 SHEET METAL ROOFING

- A. Galvanized Steel Sheet: ASTM A755/A755M; structural steel sheet, G90 zinc coating; 24 gage thick core steel, shop pre-coated with two coat fluoropolymer top coat.
 - 1. Seam: 1" snap-on with extruded vinyl weatherseal.
 - 2. Fasteners: Concealed.
 - 3. Finish: Smooth.
 - 4. Color: Berridge, Champagne metallic.
- B. Washcoat: Finish concealed side of metal sheets with white washcoat compatible with finish system, as recommended by finish system manufacturer.

2.2 ACCESSORIES

- A. Fasteners: Same material and finish as roofing metal, with soft neoprene washers.
- B. Underlayment: ASTM D226; Type II, No. 30 unperforated asphalt felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Protective Backing Paint: FS TT-C-494, Bituminous.
- E. Sealant: Refer to Section 07 90 00.
- F. Plastic Cement: ASTM D4586, Type I.
- G. Ice Dam Membrane: Bitec Ice and Water Shield, or approved equal.

2.3 FABRICATION

- A. Form sections shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, to interlock with sheet.
- C. Fabricate starter strips of same material as sheet, continuous, to interlock with sheet.
- D. Form pieces in longest practical lengths.
- E. Hem exposed edges on underside **1/2 inch**; miter and seam corners.
- F. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. No exposed fasteners.
- G. Fabricate corners from one piece with minimum **18 inch** long legs; [seam] [solder] for rigidity, seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward **1/4 inch** and hemmed to form drip.

- I. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

PART 3 EXECUTION

3.1 PREPARATION

- A. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
- B. Broom clean deck surfaces under eave protection and underlayment.
- C. Install starter and edge strips, and cleats before starting installation.
- D. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.
- E. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.2 INSTALLATION

- A. Ice Dam Membrane Installation:
 - 1. Place eave edge metal flashings tight with fascia boards. Weather lap joints minimum 2 inches and seal with plastic cement. Secure flange with nails at maximum 12 inches on center.
 - 2. Apply 4 inch wide band of plastic cement over deck flange of eave edge flashings, and embed minimum 19 inch wide strip of ice dam membrane. Place underlayment starter strip with eave edge flush with face of flashings. Secure in place. Lap ends minimum 6 inches.
 - 3. Apply lap cement at rate of approximately 1-1/4 gal/100 sq ft over starter strip.
 - 4. Starting from lower edge of starter strip, lay additional 36 inch wide strips of ice dam membrane in lap cement, to produce two ply membrane. Weather lap plies minimum 19 inches and nail in place. Lap ends minimum 6 inches. Stagger end joints of each consecutive ply.
 - 5. Extend ice dam membrane minimum 2 ft up-slope beyond interior face of exterior wall.
- B. General Roofing Installation Requirements:
 - 1. Apply underlayment in single layer laid perpendicular to slope; weather lap edges 2 inches and nail in place. Minimize nail quantity.
 - 2. Install insulation in accordance with manufacturer's instructions. Protect from UV exposure until roofing can be installed.
 - 3. Install metal roofing in accordance with manufacturer's instructions. Cleat and seam joints.
 - 4. Use plastic cement for joints between metal and bitumen and for joints between metal and felts.
- C. Flashing Installation: Refer to Section 07 62 00.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flashings and counterflashings.
 - 2. Fabricated sheet metal items.

1.2 DESIGN REQUIREMENTS

- A. Sheet Metal Flashings: Conform to the following criteria of SMACNA "Architectural Sheet Metal Manual."

1.3 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

1.4 WARRANTY

- A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.
- B. Guaranty: Guaranty sheet metal work installed under this Section against leakage or defects for 2 years after substantial completion date. Make good at Contractor expense or defects occurring within this period.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

- A. Manufacturers:
 - 1. Imetco
 - 2. PacClad
 - 3. ColorKlad
 - 4. Berridge
 - 5. Substitutions: Permitted.
- B. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; structural steel sheet, G90 (Z275) zinc coating; 24 gage core steel, shop pre-coated with two coat fluoropolymer top coat.
 - 1. Color: To match Imetco Wall Panel Color, Champagne.

2.2 ACCESSORIES

- A. Fasteners: All metal counter flashing and parapet cap flashing shall be attached with galvanized or cadmium plated screws with neoprene washers. Nails, screws and rivets used at other locations are to be the appropriate type for the purpose as described in the latest edition of the SMACNA Design Manual.
- B. Roofing Cement: F.S. SS-C-153, Type I, Class A (summer grade) or Class B (winter grade) as applicable.
- C. Underlayment: ASTM D226; Type II, No. 30 unperforated asphalt felt.
- D. Protective Backing Paint: FS TT-C-494, Bituminous.
- E. Sealant: Type specified in Section 07 90 00.
- F. Plastic Cement: ASTM D4586, Type I.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Form sheet metal accurately to dimensions and shapes required, watertight and weathertight, with angles and broken surfaces true, sharp, and in straight lines. Where intercepting other members, cope to an accurate fit and solder securely. Produce flat surfaces free from waves and buckles.
- B. Expansion: Allow a 3/8"-1/2" gap in coping caps between each section. Use 3-1/2" wide prefinished 24 gage cover plate over joints.
 - 1. Set cover plates in visible bead of polyurethane sealant between the cap and cover plate. Wipe joints of excessive sealant.
 - 2. Attach cover plate at the front and back with hex head cadmium screws with neoprene washers, installed in the gap between the metal cap sections.
 - 3. Do not exceed maximum length of 10'-0" for cap, fascia and flashing sections. Furnish with factory formed slots or enlarged holes for fasteners.
- C. Paint metal in contact with mortar, concrete, and masonry materials with an alkali resistant coating. Use heavy-bodied bituminous paint or approved equal.

3.2 MISCELLANEOUS FLASHING

- A. General:
 - 1. Where exposed portions are used as a counter-flashings, lap base flashings at least four inches and use thickness of metal as specified for exposed locations.
 - 2. Exposed edge of flashing may be formed as a receiver for two piece counter flashing.
 - 3. Terminate exterior edge beyond face of wall approximately 1/4-inch with drip edge where not part of counter flashing.

4. Turn back edge up 1/4-inch unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
5. Terminate interior raised edge in masonry backup unit approximately 2 inches into unit unless shown otherwise.
6. Under copings terminate both edges beyond face of wall approximately 1/4-inch with drip edge.
7. Lap end joints not less than four inches. Seal laps with sealant.
8. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound.
9. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
10. Where ends of flashing terminate turn ends up 1 inch and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
11. Turn flashing up not less than 8 inches between masonry wythes or behind exterior veneer.
12. Secure flashings in place using concealed fasteners.
13. Seal metal joints watertight.
14. Connect downspouts to storm sewer system.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Firestopping and through-penetration protection system materials and accessories.
 - 2. Firestopping tops of fire rated walls.
 - 3. Smoke sealing.

1.2 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

1.3 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance and limitation criteria.
- B. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- C. Manufacturer's Installation Instructions: Submit preparation and installation instructions.
- D. Manufacturer's Certificate: Certify products and assemblies meet or exceed specified requirements and applicable code requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.
- D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

- A. Manufacturers:
 - 1. Hilti Corp.
 - 2. 3M Fire Protection Products.
 - 3. Specified Technologies.
 - 4. Substitutions: Not Permitted.
- B. Product Description: As determined by firestop specialist as required to firestop rated partitions and openings and penetrations through those partitions.

2.2 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer.
- B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.

3.3 APPLICATION

- A. Install material at fire rated construction perimeters and openings.
- B. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- C. Label or stencil all firestops installed through penetration firestops. State that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized contractor. Label to include the firestop brand name, and the classified system number for which it was installed.
- D. Firestopping material to be flush on both sides of wall after application, neatly applied. Any firestopping surfaces not neat or too messy for painting will be required to be reinstalled.

3.4 FIELD QUALITY CONTROL

- A. Keep all areas of work accessible until inspection by the applicable Code Authorities.

3.5 CLEANING

- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

END OF SECTION

SECTION 07 90 00

JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sealants and joint backing.
 - 2. Precompressed foam sealers.
 - 3. Hollow gaskets.
 - 4. Accessories.
- B. Furnish labor, materials, tools, and equipment required to completely close (with caulking compound or sealant) all joints to give a finished appearance. Items to be caulked or sealed include but are not limited to the following:
 - 1. Hollow metal frames.
 - 2. Exterior doors, louvers, windows and any other openings in exterior walls.
 - 3. Interior fixed glass.
 - 4. Penetrations by piping, conduit and similar items.
 - 5. Plumbing fixtures.
 - 6. Millwork.
 - 7. Flooring, paving and sidewalk joints.
 - 8. Dissimilar finishes.
 - 9. Joints shown on drawings or specified to be caulked or sealed.
 - 10. All joints or gaps between similar or dissimilar materials that do not receive closure trim are to be caulked/sealed with the appropriate material as listed in Part 2 of this Section.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.4 WARRANTY

- A. Furnish to the Architect, in duplicate, the following written guarantee before final payment will be made for Work under this part of the Contract:

"This firm guarantees to promptly repair and replace, without further cost to the Owner, the whole or any part of the materials which prove defective through workmanship or improper materials within 2 years of the date of final acceptance. This includes damage

to the building caused by defective workmanship and/or improper materials or that which is caused by repair or replacement of defective materials or workmanship."

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Pecora Corp.
 - 3. Tremco Sealants & Waterproofing.
 - 4. Substitutions: Permitted.
- B. High Performance General Purpose Exterior (Nontraffic) Sealant: Silicone such as Dow 790 or approved equal; ASTM C920 non-sag.
- C. General Purpose Traffic Bearing Sealant : Polyurethane; ASTM C920, pourable. Refer to civil specifications.
- D. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
- E. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer.
- C. Joint Backing: Round foam rod compatible with sealant.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces and joint openings are ready to receive work. Beginning of installation constitutes acceptance of conditions.
- B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.

- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Tool joints concave.
- G. Precompressed Foam Sealant: Install with face 1/8 to 1/4 inch below adjoining surface.
- H. Compression Gaskets: Install with face 1/8 to 1/4 inch below adjoining surface.
- I. Seal all interior joints where unlike materials meet and joints do not close tight. Finish smooth with adjacent surfaces, suitable for painting.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Steel doors and frames; non-rated and fire rated.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. ANSI 250.8 – Recommended Specifications for Standard Steel Doors and Frames.
 - 2. DHI – Door Hardware Institute – The Installation of Commercial Steel doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builder’s Hardware.
- B. Conform to requirements of ANSI A250.8.
- C. Fire Rated Door and Frame Construction: Conform to one of the following:
 - 1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
 - 2. UL 10C.
- D. Fire Rated Door and Frame Construction: Conform to UBC Standard 7-2.
- E. Installed Fire Rated Door and Frame Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- F. Fire Rated Stair Doors and Frames: Rate of rise of 450 degrees F across door thickness.
- G. Attach label from agency approved by authority having jurisdiction to identify each fire rated door frame.

PART 2 PRODUCTS

2.1 STEEL DOORS AND FRAMES

- A. Manufacturers:
 - 1. Amweld Building Products, Inc.
 - 2. Ceko Door Products
 - 3. Republic Doors

- 4. Steelcraft
- 5. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Doors (Insulated): ANSI A250.8, SDI 108, 1-3/4 inch thick; 18 gage.
 - 1. Level 2 - Heavy Duty, Model 1, full flush design.
- B. Frames:
 - 1. Level 2 for Door Models 1, 16 gage/0.053 inch thick.
- C. Door Core: Cardboard honeycomb. Polystyrene is NOT acceptable.
- D. End Closure: Channel, 0.04 inch thick, inverted.

2.3 ACCESSORIES

- A. Silencers: Resilient type.
- B. Removable Stops: Rolled steel channel shape.
- C. Primer: ANSI A250.10 rust inhibitive type.
- D. Weatherstripping: Specified in Section 08 71 00.

2.4 FABRICATION

- A. Fabricate frames as face welded units.
- B. Fabricate doors and frames with hardware reinforcement welded in place.
- C. Configure exterior frames and doors with profile to receive recessed weatherstripping.
- D. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- E. Attach fire rating label to each fire rated door and frame. Indicate temperature rise rating for stair doors.

2.5 SHOP FINISHING

- A. Primer: Baked.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install doors and frames in accordance with ANSI A250.8.

- B. Install roll formed steel reinforcement channels between two abutting frames.
- C. Install fire rated assemblies in accordance with NFPA 80.
- D. Adjust door for smooth and balanced door movement.
- E. Tolerances:
 - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 11 25

INTERIOR FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Steel frames for doors and windows, with prefinished aluminum cap/trim; rated and non-rated.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver frames packaged to provide protection during transit and storage at project site.
- B. Store frames at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.4 WARRANTY

- A. Frames: Two year warranty.

PART 2 PRODUCTS

2.1 INTERIOR ALUMINUM FRAMES

- A. Manufacturers:
 - 1. Timely
 - 2. Substitutions: Permitted.

2.2 FRAMES

- A. Interior Frames: Throat size to fit wall opening; 2" profile with flush snap-on aluminum cap/trim. These are NOT storefront frames. Provide fire rated frames where noted on Drawings, or as otherwise required by code.
- B. Aluminum: ASTM B221; controlled alloy billets of 6063T5, to assure compliance with tight dimensional tolerances and maintain color uniformity. Extruded aluminum thickness of 0.062 in.

2.3 FABRICATION

- A. Pre-machine jambs and prepare for hardware, with concealed reinforcement plates, drilled and tapped as required, and fastened within frame.
- B. Coordinate with hardware specified in Section 08 71 00.

- C. Provide vinyl or mohair mute.
- D. Provide corner alignment clips for precise butt or mitered connections.
- E. Fabricate all components to allow secure installation without exposed fasteners.

2.4 FACTORY FINISHING

- A. Factory Finish extruded frame so that any part exposed to view upon completion of installation to be uniform in finish and color.
- B. Clear Anodic Coating: AAMA 611, AAM12C22A21 clear anodized coating, 0.4 mil minimum thickness.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine project conditions and verify that the work of this section may properly commence. Beginning of installation constitutes acceptance of conditions.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's installation instructions. Install plumb and square, securely anchored to substrates with fasteners recommended by manufacturer.
- B. Secure concealed installation clips to main structural extrusion, not to snap-in or trim members.
- C. Do not use screws or other fasteners that will be exposed to view when installation is complete.
- D. Coordinate installation of hardware specified in Section 08 71 00.

3.3 CLEANING

- A. Clean frames after installation, using cleaning methods recommended by frame manufacturer.
- B. Touch up marred areas so that touch-up is not visible. Remove and replace frames that cannot be satisfactorily adjusted.
- C. Provide protection to assure that frames will be without damage or deterioration upon Substantial Completion.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flush wood doors; flush and flush glazed configuration; fire rated and non-rated; factory finished.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.
- C. Samples: Required.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with NWWDA I.S.1.
- B. Fire Rated Door Construction: Conform to NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
- C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1.4 WARRANTY

- A. Furnish manufacturer's "Life of Installation" warranty for interior doors.

PART 2 PRODUCTS

2.1 FLUSH WOOD DOORS

- A. Manufacturers:
 - 1. Algoma Hardwoods Inc.
 - 2. Eggers Industries.
 - 3. Marshfield Door Systems.
 - 4. Mohawk Flush Doors, Inc..
 - 5. Graham.
 - 6. Substitutions: Permitted.
- B. Flush Interior Doors: 1-3/4 inches thick; solid core, five ply construction, fire rated as indicated on Drawings.

2.2 COMPONENTS

- A. Solid Core, Non-Rated: AWI Section 1300, Type PC - Particleboard.
- B. Solid Core, Fire Rated: AWI Section 1300.
- C. Veneer Facing: AWI Premium quality wood, plain sliced, with book matched grain, for transparent finish.
 - 1. Wood: Walnut.
 - 2. Finish: VT Industries, Onyx ON 18, or approved equal.
- D. Facing Adhesive: Type I - waterproof.

2.3 ACCESSORIES

- A. Glazing Stops: Wood with metal clips for rated doors.

2.4 FABRICATION

- A. Fabricate doors in accordance with AWI Quality Standards requirements.
- B. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Factory machine doors for finish hardware.

2.5 SHOP FINISHING

- A. Finish work in accordance with AWI - Section 1500 Factory Finishing; Premium Quality; Stained Transparent.
- B. Seal door top edge with sealer to match door facing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with AWI Quality Standards requirements.
- B. Adjust door for smooth and balanced door movement.
- C. Tolerances: Conform to NWWDA requirements for fit and clearance tolerances and maximum diagonal distortion.

END OF SECTION

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefronts.
 - 2. Aluminum and glass doors and frames and hardware.
 - 3. Glass.
 - 4. Sunshades.
 - 5. Tube fins.
- B. Related Sections:
 - 1. Section 08 44 13 - Glazed Curtain Wall System

1.2 PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
- B. Performance Requirements:
 - 1. Air Infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per sq. ft. of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
 - 2. Water Infiltration: No uncontrolled water penetration when tested in accordance with ASTM E331 at test pressure of 10.0 psf.

1.3 SUBMITTALS

- A. Shop Drawings: Required.
- B. Submit type of sealant, if performing sealant work under this section, and color chips for selection.

1.4 WARRANTY

- A. Furnish five year manufacturer warranty for glazed units.
- B. Furnish 10 year warranty for finish.
- C. Provide manufacturer's standard lifetime warranty for entry doors.
- D. Submit a warranty signed by the manufacturer, contractor, installer, agreeing to replace aluminum doors, windows, framing and glazing which fall in materials and workmanship within 2 years of the date of acceptance. Failure of materials or workmanship shall include, but not be limited to, failure in operation of doors, windows, and hardware, excessive leakage of air infiltration, excessive deflections, delamination of panels,

deterioration of finish or metal in excess of normal weathering, and defect in accessories, weatherstripping, and other components of the work.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

- A. Manufacturers:
 - 1. Tubelite
 - 2. YKK AP America.
 - 3. Substitutions: Permitted.
- B. Product Description:
 - 1. Aluminum Frame: Thermally broken. Frames for interior glazing need not to be thermally broken.
 - 2. Doors: Medium stile; nominal 10 inch high bottom rail.
 - 3. Subsill: Manufacturer's standard High-Performance (HP) subsill.

2.2 COMPONENTS

- A. Extruded Aluminum: ASTM B221.
- B. Sheet Aluminum: ASTM B209.
- C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.
- D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.
- E. Glass: Specified in Section 08 80 00.
- F. Hardware: Refer to Section 08 71 00.
- F. Perimeter Sealant: Specified in Section 07 90 00.

2.3 SUNSHADES AND FINS

- A. Sunshades: Tubelite, Maxshade "Z" Blade
 - 1. Outrigger: Straight.
 - 2. Blade: Airfoil.
 - 3. Facia: Rectangular.
- B. Tube Type: As shown on Drawings.
- C. Anchor directly to storefront vertical mullions.

2.4 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Prepare components with internal reinforcement for door hardware.
- F. Reinforce framing members for imposed loads.

2.5 SHOP FINISHING

- A. Anodized Aluminum Surfaces: AAMA 611, Class I 0.7 mils clear anodized coating.
- B. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install wall system and sunshades in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Install sill flashings. Turn up ends and edges to form water tight dam.
- C. Install and adjust door hardware as required to meet the Americans With Disabilities Act (ADA).

3.1 PROTECTION AND CLEANING

- A. Protection: After erection, adequately protect by masking, light motor oil, or other acceptable covering all exposed parts of the work and the finish from damage by grinding and polishing machines and/or by plaster, lime, cement, acid or other harmful substances.
- B. Cleaning: After completion of all other work in the vicinity of the aluminum doors, windows, and framing, remove all masking, or other covering used to protect the work, and thoroughly clean the aluminum surfaces with soap and plain water or a petroleum product such as white gasoline, kerosene, or distillate. Do not use abrasive cleaning agents.

END OF SECTION

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum curtain wall systems, complete with reinforcing, shims, anchors and attachment devices.
 - 2. Accessories necessary to complete Work.
- B. Related Sections:
 - 1. Section 08 41 13: Aluminum Framed Storefront and Entrances
 - 2. Section 08 80 00: Glazing

1.2 SYSTEM REQUIREMENTS

- A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.
- B. Performance Requirements:
 - 1. Air Infiltration: Air leakage shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
 - 2. Water Infiltration: No uncontrolled water penetration when tested in accordance with ASTM E 331 at test pressure of 10.0 psf, or 20 percent of full positive design wind load, whichever is greater.
 - 3. Thermal Transmittance (U factor): AAMA 1503; maximum 0.66 BTU/hr/ft² per AAMA 507.
- C. Structural Requirements:
 - 1. Wind loading: Resist wind pressure of 90 mph.
 - 2. Deflection under uniform loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed 1/175 of span.
 - 3. Seismic: Must meet Classification "C" of International Building Code, 2006 Edition.
- D. Thermal Requirements: Framing systems shall accommodate expansion and contraction movement due to surface temperature differential of 180 degree Fahrenheit (82 degree Celsius) without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's descriptive literature for each manufactured product.
 - 2. Include information for factory finishes, accessories and other required components.

- B. Shop Drawings:
 - 1. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units and member connections.
 - 2. Show following items:
 - a. Details of special shapes.
 - b. Reinforcing.
 - c. Anchorage system.
 - d. Interfacing with building construction.
 - e. Provisions for expansion and contraction.
 - f. Thermal breaks.
 - 3. Indicate typical glazing details, locations of various types and thickness of glass and internal sealant requirements as recommended by sealant manufacturer.
 - 4. Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.
 - 5. Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.
- C. Test Reports: Submit certified copies of previous test reports by independent laboratory substantiating performance of system. Include other supportive data as necessary.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.
- B. Installer Qualifications: Certified in writing by Contractor as qualified for installation of specified systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 01 60 00.
- B. Protect finished surfaces to prevent damage.
- C. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.
- D. Do not leave coating residue on surfaces.

1.6 PROJECT CONDITIONS

- A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.7 WARRANTY

- A. Provide warranties in accordance with Section 01 70 00.
- B. Provide written manufacturer's warranty, executed by company official, warranting against defects in materials and products for 2 years from date of Substantial Completion. Warrant door corner construction for the life of the project.

- C. Provide written installer's warranty, warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 2 years from date of Substantial Completion.
- D. Furnish 10 year warranty for finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Tubelite Series 200 is specified. Equal or superior systems will be considered for substitution in accordance with Section 01 60 00.

2.2 FRAMING MATERIALS AND ACCESSORIES

- A. Aluminum: ASTM B 221, 6063-T6 alloy and temper.
- B. Anchors: Aluminum. Provide insulation if steel anchors are used.
- C. Thermal Barrier: Extruded of silicone compatible elastomer that provides for silicone adhesion.
- D. Hardware: Refer to Section 08 71 00.

2.3 GLASS AND GLAZING ACCESSORIES

- A. Refer to Section 08 80 00.
- B. Gaskets: ASTM C864.
 - 1. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
 - 2. Provide factory molded corners at exterior.

2.4 SYSTEM FABRICATION

- A. Take accurate field measurements to verify required dimensions prior to fabrication.
- B. Fabricate components in accordance with approved shop drawings. Remove burrs and smooth edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing and assembly. Disassemble only to extent necessary for shipping and handling limitations.
- C. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
- D. Prepare components to receive anchor devices.
- E. Arrange fasteners and attachments to conceal from view.
- F. Steel Components:
 - 1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
 - 2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 mil minimum dry film thickness.

- G. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.
- H. Provide holes or slots, deflector plates, water deflectors, and sealants to accommodate internal weep and drainage to the exterior of curtain wall system.
- I. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- J. Separate dissimilar metals with protective coating or pre-formed separators to prevent contact and corrosion.

2.5 FINISH

- A. Anodized Aluminum Surfaces: AAMA 611, Class I 0.7 mils clear coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with Work in accordance with Section 01 40 00.
- B. Verify dimensions, tolerances and method of attachment with other Work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.
- B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.
- C. Tolerances:
 - 1. Limit variations from plumb and level:
 - a. 1/8 inch in 20 feet vertically and horizontally.
 - b. 1/4 inch in 40 feet either direction.
 - 2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
 - a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
 - b. 1/8 inch
 - c. for surfaces separated by more than 2 inches.
 - 3. Step in face: 1/16 inch maximum.
 - 4. Jog in alignment: 1/16 inch maximum.
 - 5. Location: 1/4 inch maximum deviation of any member at any location.
 - 6. Tolerances are not accumulative.
- D. Provide attachments and shims to permanently fasten system to building structure.
- E. Anchor securely in place, allowing for required movement, including expansion and contraction.

- F. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with protective coating or pre-formed separators to prevent contact and electrolytic action.
- G. Seal perimeter members as shown on manufacturer's installation instructions or as required for unique job conditions. Set other members with internal sealants and baffles as called for in manufacturer's installation instructions. Use sealants as recommended by sealant manufacturer.
- H. Provide adequate support for all the aluminum frames, glass deadloads, and for the end reactions to specified windloads.
- I. Glazing:
 - 1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception, including surface preparations. Refer to Section 08 80 00 for additional requirements.

3.3 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears and other foreign materials.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the supply and installation of the Finish Hardware.
 - 1. Include the termination of all Electrified Hardware.
 - 2. Include field verification of any existing doors, frames or hardware.
- B. Related Sections
 - 1. Division 1
 - 2. Sealants –Division 7
 - 3. Openings –Division 8
 - 4. Finishes –Division 9
 - 5. Fire Alarm –Division 28
 - 6. Electrical –Division 26
 - 7. Security –Division 28

1.02 REFERENCES

- A. Documents and Institutes that shall be used in estimating, detailing and installing the items specified.
 - 1. International Building Code – Current/Adopted Edition
 - 2. ICC/ANSI A117.1 – Accessible and Usable Building and Facilities -Current/Adopted Edition
 - 3. NFPA 70 – Current/Adopted Edition
 - 4. NFPA80 –Standards for Fire Doors and Fire Windows – Current/Adopted Edition
 - 5. NFPA101 – Life Safety Code – Current/Adopted Edition
 - 6. NFPA105 – Installation of Smoke-Control Door Assemblies – Current/Adopted Edition.
 - 7. ANSI - American National Standards Institute
 - 8. BHMA – Builders Hardware Manufacturers Association
 - 9. UL – Underwriters Laboratory
 - 10. DHI – Door and Hardware Institute
 - 11. Accessibility Standards – Current Adopted Edition
 - 12. Local Building Codes

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Division 01.
- B. Finish Hardware Schedule to be in vertical format to include:
 - 1. Heading #/Hardware Set
 - 2. Door #, Location, Hand, Degree of Opening, Door Size and Type, Frame Size and Type, Fire Rating
 - 3. Quantity, type, style, function, product, product number, size, fasteners, finish and manufacturer of each hardware item.
 - 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

5. Keying schedule
 6. Title Sheet, Index, Abbreviations, Manufacturers List, Template List and Templates.
 7. Mounting locations for hardware.
 8. Explanation of abbreviations, symbols, and codes contained in schedule.
 9. Date of the Finish Hardware Specification and Drawing / Door Schedule used in completing the Finish Hardware Schedule.
 10. In Name, Company and Date of Field Verification if required.
 11. Door Index; include door number, heading number, and hardware group.
 12. Name and phone number for local manufacturer's representative for each product.
 13. Submit in conjunction with Door and Frame Submittal.
 14. Operation Description of openings with electrified hardware.
- C. Product Data: Provide product data in the form of a binder, manufacturer's technical product fact sheets for each item of hardware. Include whatever information may be necessary to show compliance with requirements, including instructions for installation and for maintenance of operating parts and finish.
- D. Wiring Diagrams: Provide Riser/Elevation and Point to Point Wiring Diagrams for all openings with electrified hardware. Include all information that is necessary for coordination with other trades.
- E. Samples: Provide samples as requested by Owner or Architect with Heading # and Door# marked on boxes. All samples will be returned to the contractor and used on doors for which they were marked.
- F. Templates: Provide templates of finish hardware items to each fabricator of doors, frames and other work to be factory or shop prepared for the installation of hardware.
- G. Keying Schedule: After meeting with the Owner, a keying schedule shall be submitted using keyset symbols referenced in DHI manual "Keying Systems and Nomenclature." The keying schedule shall be indexed by door number, keyset, hardware heading number, cross keying instructions and special key stamping instructions.
- H. Operations and Maintenance Data: At the completion of the job, provide to the Owner one hard copies or one electronic copy of an Owner's operation and maintenance manual. The manual shall consist of a labeled hardcover three ring binder with the following technical information:
1. Title page containing: Project name, address and phone numbers. Supplier's name, address and phone numbers.
 2. Table of Contents.
 3. Copy of final (file and field use/as-installed) Finish Hardware Schedule.
 4. Final Keying Schedule.
 5. Maintenance instruction, adjustment, and preservation of finishes for each item of hardware.
 6. Catalog pages for each items of hardware.
 7. Installation Instructions for each item of hardware
 8. Parts List for each item of hardware.
 9. As installed point to point wiring diagrams for electrified hardware.
 10. Warranties include Order #.

1.04 QUALITY ASSURANCES

- A. Substitutions: Request for substitutions shall not be accepted within this project. Architect, Owner and Finish Hardware Consultant have selected one (1) specified and two (2) equals listed hereinafter in the Hardware Schedule. By this selection process they have established three (3) equal products for competitive pricing, while insuring no unnecessary delays by a substitution process. If any specified product is listed as a "No Substitution" product, this product will be supplied as specified, with no alteration or request of substitution. The reason for this is to comply with the uniformity established at this project. Parts and supplies are inventoried for these particular products for ease and standardization of replacement.
- B. Supplier Qualifications: Supplier shall be recognized architectural finish hardware supplier, with warehousing facilities, who have been furnishing hardware in the project vicinity for a period of not less than 2 year and who is or employs a DHI Certified AHC, DHC, DHSC or person with a minimum of 10 years of experience as a hardware supplier. This person shall be available at reasonable times during the course of the work for consultation about products hardware requirements, to the Owner, Architect and General Contractor.
- C. Installer Qualifications (Mechanical Hardware): All finish hardware shall be installed by the Finish Hardware Installer with a minimum of at least two (2) years documented experience. Installer shall attend a pre-installation meeting between the General Contractor, Finish Hardware Supplier/s, hardware manufacturer's representative for locks, closers and exit devices, and all door / frame suppliers. The Finish Hardware Installer shall be responsible for the proper installation and function of all doors and hardware.
- D. Installer Qualifications (Electrified Hardware): All electrified finish hardware (power source, electrified locking or control device, switching device, through wire device and monitoring device) shall be installed by an Electronic Access Control Installer licensed by the Texas Department of Public Safety. The Electrified Finish Hardware Installer shall have a minimum of at least two (2) years of documented experience. Installer shall attend a pre-installation meeting between the General Contractor, Finish Hardware Supplier/s, Electrical Contractor, Fire Alarm Contractor, Security Contractor, hardware manufacturer's representative for electrified hardware, all door / frame suppliers. The Electrified Finish Hardware Installer shall be responsible for the proper installation, termination and function of all opening with electrified hardware. Installation shall include termination of all electrified products (including the required wire to the power supply and/or junction box).

1.05 DELIVERY, STORAGE AND HANDLING

- A. Marking and Packaging: Mark each item or package separately, with identification related to hardware set number, door number and keyset symbol.
- B. Delivery:
 - 1. Deliver individually packaged and properly marked finish hardware at the proper time and location to avoid any delays in construction or installation.
 - 2. At time of delivery, inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- C. Storage: Store hardware in enclosed, dry and locked area.

1.06 WARRANTY

- A. All finish hardware products shall be covered by a 1 year factory warranty from the date of substantial completion of the project.
- B. Supply warranty verification to the owner for all products that provide factory warranty. Warranty should include Factory Order # and date.

1.07 MAINTENANCE/EXTRA MATERIALS

- A. Extra Materials:
 - 1. All extra screws, fasteners, and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Screws and Fasteners:
 - 1. Coordinate with door supplier and manufacturer to ensure proper blocking and reinforcement is provided to support wood or machine screws when mounting panic hardware and door closers. If proper blocking and reinforcement is not included provide through bolts sized to the thickness of the door. All fasteners should be the proper type and length for the product being supplied.
 - 2. All finish hardware shall be installed to manufacturer's recommendations, using screws, attachments and installation tools provided with the hardware. No other screws or attachments are acceptable.
 - 3. All other products to meet door and frame conditions.
- B. Hinges:
 - 1. Template: Provide templated units only.
 - 2. Exterior: All exterior hinges shall be stainless steel base with stainless steel pin and stainless steel finish.
 - 3. Interior: All interior hinges steel based.
 - 4. Interior corrosive: All interior hinges at corrosive areas shall be stainless steel base with stainless still pin and stainless steel finish.
 - 5. All hinges on doors over 36" wide, with exit devices, or with push/pull shall be heavy weight.
 - 6. Electric Hinge: Provide minimum 8 wire.
 - 7. Provide non-removable pins for outswinging doors that are locked or are lockable.
 - 8. All hinges on doors with door closers shall be ball bearing.
 - 9. All hinges shall be full mortise.
 - 10. Size: Provide 4 ½ x 4 ½ hinges on doors up to 3'0" in width. Provide 5 x 4 ½ hinges over 3'0" to 4'0" in width. Reference manufacturers catalog for all other sizes.
 - 11. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
 - 12. Adjust hinge width as required for door, frame, trim and wall conditions to allow proper degree of opening.
 - 13. Provide hinges conforming to ANSI/BHMA A156.1.

14. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.
15. Supply from the following list of manufacturers:

Ives	IVE
Hager	HAG
Stanley	STA

C. Continuous Hinges:

1. Continuous hinges to be manufactured of 6063-T6 aluminum.
2. Continuous hinge shall be certified to ANSI 156.26, Grade 1
3. Continuous hinge should be tested an approved UL10C.
4. Electrified – Provide minimum 8 wire with removable panel.
5. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted.
6. Provide reinforcing for doors weighing over 450 pounds and up to 600 pounds.
7. Supply from the following list of manufacturers:

Ives	IVE
Select	SEL
Stanley	STA

D. Mortise Locks:

1. All locks on this project should be manufactured by the same manufacturer.
2. Mortise locksets shall meet ANSI/BHMA A156.13, Series 1000, Grade 1 Operational with all standard trims and conventional mortise cylinders.
3. All mortise locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
4. Provide locks with a standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8" lip strike is necessary at pair with overlapping astragal.
6. Provide dust box.
7. Supply from the following list of manufacturers:

Schlage	SCH
Falcon	FAL
Corbin Russwin	C-R
Sargent	SAR

E. Cylindrical Locks:

1. All locks on this project should be manufacturer by the same manufacturer.
2. All locks shall meet the new ANSI/BHMA A156.2, Series 4000, Grade 1.
3. All cylindrical locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with a 1/2 inch (13 mm) latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8" lip strike is necessary at pair with overlapping astragal.
6. Provide dust box.
7. Lockset shall adjust to fit door thickness from 1 3/4" to 2 1/8".
8. Supply from the following list of manufacturers:

9.	Schlage	SCH
	Falcon	FAL
	Corbin Russwin	C-R
	Sargent	SAR

F. Exit Devices:

1. All exit device types on this project should be manufactured by the same manufacturer.
2. Exit devices are to be architectural grade touch bar type. Touchpad to extend one half of door width.
3. Mechanism case to be smooth.
4. Exit devices shall meet ANSI A156.3, Grade 1.
5. All exit devices are UL listed Panic Exit or Fire Exit Hardware.
6. All lever trim to match lock trim in design and finish.
7. Dogging: Non-rated devices are to be provided with dogging. Less dogging where shown in Hardware Sets (some exterior, electrical rooms, electrified) Cylinder dogging as shown in hardware sets.
8. Exit devices are to be supplied and installed with thru-bolts for exterior, hollow metal doors, or as required for application.
9. Provide proper power supply for exit devices as required. Coordinate with Fire Alarm, Electrical and Security Contractor.
10. Push pads shall be metal, no plastic inserts allowed.
11. Exit devices shall have a flush end cap.
12. Exit devices shall be ordered with the correct strike for application.
13. Exit devices shall be order in the proper length to meet door width.
14. Exit devices shall have deadlatching.
15. Exit device shall be provided in width/height required based on door size.
16. Install exit devices with fasteners supplied by exit device manufacturer.
17. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits as required.
18. Provide proper concealed vertical rods for wood or hollow metal doors as required.
19. Factory or field drill weep holes for exit devices used in full exterior applications, highly corrosive areas, and where noted in the hardware sets.
20. Supply from the following list of manufacturers:

Von Duprin	VON
Sargent	SAR

G. Flush Bolts:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.
2. Supply from the following list of manufacturers:

Ives	IVE
Trimco	TRI
Rockwood	ROC

H. Pull Plates/Pulls/Push Plate:

1. Pull and Push Plates to meet ANSI 156.6 for .050" thickness.

2. Pull and Push Plate size to 4" x 16".
3. Pull Plate to have 10" center and 1" round on pull plate with concealed fasteners.
4. Provide straight and offset pulls with fasteners as required
5. Provide concealed fasteners for all applications.
6. Prep plate for cylinder/lock as required.
7. Supply from the following list of manufacturers

Ives	IVE
Trimco	TRI
Rockwood	ROC

I. Door Closers:

1. All door closers on this project should be manufactured by the same manufacturer.
2. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
3. Door closers shall be furnished with standard cover. Provide full cover as shown in hardware sets.
4. Size in accordance with the manufacturer's recommendations for door size and condition.
5. Door closers shall be furnished with delayed action, hold-open as listed in the Hardware Sets.
6. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors.
7. All closer installation shall include thru bolts on exterior, hollow metal doors or where required for application.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
9. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
10. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
11. Supply from the following list of manufacturers

LCN	LCN
Falcon	FAL
Corbin Russwin	C-R
Sargent	SAR

J. Door Protection Plates:

1. Protective plates shall meet ANSI A156.6 requirements for .050 thickness.
2. Protection plates should be fabricated from stainless steel.
3. Protection plate shall be height as shown in Hardware Sets. Width shall be 10" by 2" less than door width on single door or pair with a mullion and 1" less than door width on pair of doors without a mullion.
4. Beveled 4 edges.
5. Provide kickplate on all doors with closers, unless not required for aesthetic reasons.
6. Prep protective plates for hardware as required.
7. Supply from the following list of manufacturers:

Ives	IVE
Rockwood	ROC
Trimco	TRI

- K. Door Stops and Holders:
1. Supply wall stops at all openings to protect doors or door hardware. Install so lock does not lock unintentionally. Install blocking in wall where wall stop will be mounted.
 2. When wall conditions do not permit use of wall stop provide floor stops with risers as needed to adjust for floor conditions.
 3. When wall conditions do not permit use of wall stop provide overhead stops. Jamb mount where required to not be visible from Corridor.
 4. Exterior Ground Level Doors: Provide security floor stop.
 5. Exterior Roof Doors: Provide heavy duty overhead stop.
 6. Supply from the following list of manufacturers:
 Glynn Johnson GLY
 Rockwood ROC
 Trimco TRI
- L. Silencers:
1. Provide silencers on all doors without seal. 3 for single doors and 2 for pairs.
 2. Provide silencers as required for frame conditions. SR64 for hollow metal frames. SR65/SR66 for wood frames.
 3. At wood frames, insure height of stop is compatible with silencer.
 4. Supply from the following list of manufacturer's
 Ives IVE
 Rockwood ROC
 Trimco TRI
- M. Thresholds/Weatherstripping:
1. Thresholds on doors in the accessible path shall conform to accessibility codes.
 2. Threshold should be based on sill detail.
 3. Smoke seal shall be teardrop design bulb seal.
 4. Exterior seal/thresholds shall be silicone or brush as shown in hardware sets.
 5. Drip strips shall protrude 2 ½" and be 4" wider than opening.
 6. At S Label single doors provide seals on frame to comply with UL1784
 7. At S Label pair of doors provide seals on frame and as meeting stile to comply with UL1784.
 8. Automatic Door Bottom shall be mortised to comply with accessibility codes.
 9. Supply from the following list of manufacturer's
 Zero ZER
 National Guard NGP
 Pemko PEM

2.03 KEYING

- A. General: Finish Hardware Supplier shall meet in person with owner to finalize keying requirements prior to the locks and exit devices being ordered and match existing or start a new Master Key System for the project. During keying meeting all hardware functions should be reviewed with the owner to finalize lock and exit device functions. During keying meeting determine all expansion required.
- B. Cylinders: Provide the correct and quantity of cylinders for all applications.

- C. Keys: Provide nickel silver keys only. Furnish 2 change keys for each lock and 10 master keys. Deliver all keys to Owners' Representative.
- D. Cores and keys shall be provided with identification stamping.
- E. Provide Bitting List to Owner.

2.04 KEY CONTROL

- A. Key control shall be provided, by supplying a complete key storage and management system. Provide a complete key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers and standard metal cabinet. Size of system to be 150% of the number of locks required for the project.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine doors, frames and related items for conditions that would prevent the proper application of any finish hardware items. Do not proceed with installation until all defects are corrected.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Follow Door and Hardware Institute Publication:
Recommended Location for Architectural Hardware for Standard Steel Doors and Frames
Recommended Location for Builder's Hardware for Custom Steel Doors and Frames
Recommended Locations for Architectural Hardware for Wood Flush Door
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Follow ANSI A117.1-1998 Accessible and Usable Building and Facilities and Texas Accessibility Standards.
- D. Review mounting locations with Architect where required.
- E. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers should not be visible in corridors, lobbies and other public spaces where possible.
- F. Locate power supplies in accessible location and indicate in as-builts where located.

- G. Set threshold in full bed of sealant complying with requirements specified in Division 07.
- H. Pre Installation meeting required with attendees to include Architect, General Contractor, Mechanical Hardware Installer, Electrified Hardware Installer, Finish Hardware Supplier and Manufacturer's Representative for Exit Device, Locks and Closers and Door/Frame Suppliers before installation begins.

3.03 FIELD QUALITY CONTROL

- A. After installation has been completed, obtain the services of an Architectural Hardware Consultant to check for proper installation of finish hardware, according to the finish hardware schedule and keying schedule. In addition, check all hardware for adjustments and proper operation.

3.04 ADJUST AND CLEAN

- A. Adjust, clean and inspect all hardware, to ensure proper operation and function of every opening. Replace items, which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.05 PROTECTION

- A. The General Contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

3.06 TRAINING

- A. After installation has been completed, provide training to the Owner on the operation of the Finish Hardware and programming of any electrified hardware.

3.07 HARDWARE SCHEDULE

- A. These hardware set shown below are for use as a guideline. Provide hardware as required to meet the requirements of the openings, security, and code requirements.

PROVIDE 1-1/2" EXTENDED LIP STRIKES WHERE ALUMINUM SNAP ON TRIM IS USED.

HARDWARE GROUP NO. 001

FOR USE ON DOOR #(S):

121

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
-ALL HARDWARE BY VAULT DOOR MANUFACTURER.				

HARDWARE GROUP NO. 002

FOR USE ON DOOR #(S):

105	109	110	113	114	117
118	119	201	204	205	208
212	214	215	216	217	

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
-ALL HARDWARE BY GLASS DOOR MANUFACTURER.				

HARDWARE GROUP NO. 105I

FOR USE ON DOOR #(S):

115

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA DORMITORY/EXIT LOCK	MA571P QG	626	FAL
1	EA SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA FLOOR STOP	FS410	626	IVE
1	EA GASKETING	328 H&J	AA	ZER
1	EA DOOR BOTTOM	355AA	AA	ZER
1	EA THRESHOLD	655A LENGTH AS REQ	A	ZER
1	EA DOOR SCOPE	DS/2000	689	

HARDWARE GROUP NO. 201

FOR USE ON DOOR #(S):

124

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA STOREROOM LOCK	B581P6 QUA	626	FAL
1	EA SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA WALL STOP	WS406/407CCV	630	IVE

HARDWARE GROUP NO. 201C

FOR USE ON DOOR #(S):

104 120 207

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA STOREROOM LOCK	B581P6 QUA	626	FAL
1	EA SURFACE CLOSER	SC71A SS	689	FAL
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE GROUP NO. 203N

FOR USE ON DOOR #(S):

210

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	B581P6 QUA	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE GROUP NO. 212S

FOR USE ON DOOR #(S):

116

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458 - SIZE AS REQUIRED	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	B581P6 QUA	626	FAL
2	EA	OH STOP	90S X SIZE AS REQ	630	GLY

HARDWARE GROUP NO. 341C

FOR USE ON DOOR #(S):

106 107 202 209 211

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	MA311 OCCUPIED/VACANT QGM	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188S H & J	BK	ZER

HARDWARE GROUP NO. 503

FOR USE ON DOOR #(S):

203

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	B561P QUA	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE GROUP NO. 503F

FOR USE ON DOOR #(S):

108

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	B561P QUA	626	FAL
1	EA	FLOOR STOP	FS410	626	IVE

HARDWARE GROUP NO. 701R

FOR USE ON DOOR #(S):

112

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-17	626	VON
1	EA	RIM CYLINDER	951	626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J	BK	ZER

HARDWARE GROUP NO. 731R

FOR USE ON DOOR #(S):

206

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-17	626	VON
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE GROUP NO. 801AH

FOR USE ON DOOR #(S):

122

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	DEADBOLT	MS1850 (OR DOOR MANUF STANDARD)	626	ADA
2	EA	MORTISE CYLINDER	AS REQ	626	FAL
2	SET	PUSH/PULL BAR	9190HD-33-10 NO	630	IVE
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE

-PROVIDE MOUNTING ACCESSORIES FOR CLOSERS; COORDINATE WITH DOOR/FRAME SUPPLIER.

HARDWARE GROUP NO. A800A

FOR USE ON DOOR #(S):

102

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY	628	IVE
2	SET	PUSH/PULL BAR	9190HD-33-10 NO	630	IVE
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	SURF. AUTO OPERATOR	9542 REG PUSH	ANCLR	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T	630	LCN

-PROVIDE MOUNTING ACCESSORIES FOR CLOSERS; COORDINATE WITH DOOR/FRAME SUPPLIER.

HARDWARE GROUP NO. AC714A

FOR USE ON DOOR #(S):

101

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3547A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3547A-NL-OP	626	VON
1	EA	RIM CYLINDER	951	626	FAL
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE CLOSER	SC71A SS (INACTIVE)	689	FAL
1	EA	SURF. AUTO OPERATOR	9542 REG PUSH (ACTIVE LEAF)	ANCLR	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T	630	LCN
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	SET	MEETING STILE	BY DOOR MANUFACTURER		
1	SET	PERIMETER SEAL	BY FRAME MANUFACTURER		

-PROVIDE MOUNTING ACCESSORIES FOR CLOSERS; COORDINATE WITH DOOR/FRAME SUPPLIER.

-INGRESS BY THE CARD READER OR KEY OVERRIDE.EGRESS BY THE PANIC HARDWARE.

-EGRESS BY THE ACTUATOR OR THE PANIC HARDWARE.

-THE ELECTRIFIED LATCH BOLTS WILL BE SEQUENCED WITH THE AUTOMATIC OPENERS AND RETRACT PRIOR TO THE AUTOMATIC OPENER ACTIVATING.

HARDWARE GROUP NO. AC715A

FOR USE ON DOOR #(S):

123

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-35A-NL-OP	626	VON
1	EA	RIM CYLINDER	951	626	FAL
1	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	SURF. AUTO OPERATOR	9542 REG PUSH	ANCLR	LCN
2	EA	ACTUATOR, JAMB MOUNT	8310-818T	630	LCN
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	SET	PERIMETER SEAL	BY FRAME MANUFACTURER		

-PROVIDE MOUNTING ACCESSORIES FOR CLOSERS; COORDINATE WITH DOOR/FRAME SUPPLIER.

-INGRESS BY THE CARD READER OR KEY OVERRIDE.

-EGRESS BY THE PANIC HARDWARE.

-THE ELECTRIFIED LATCH BOLT WILL BE SEQUENCED WITH THE AUTOMATIC OPENERS AND RETRACT PRIOR TO THE AUTOMATIC OPENER ACTIVATING.

HARDWARE GROUP NO. C201C

FOR USE ON DOOR #(S):

213

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	B581P6 QUA	626	FAL
1	EA	ELECTRIC STRIKE	5000 X FACEPLATE AS REQ	626	HES
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY CONTRACTOR		

-INGRESS BY THE CARD READER OR KEY OVERRIDE.

-EGRESS BY THE LEVER.

HARDWARE GROUP NO. C715

FOR USE ON DOOR #(S):

111

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL	626	VON
1	EA	RIM CYLINDER	951	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	GASKETING	188S H & J	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY CONTRACTOR		

-INGRESS BY THE CARD READER OR KEY OVERRIDE.

-EGRESS BY THE PANIC HARDWARE.

END OF SECTION

SECTION 08 80 00

GLAZING

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass and glazing for metal frames, doors, and windows.
 - 2. Glass and glazing materials and installation requirements are included in this section for other sections referencing this section.

1.2 PERFORMANCE REQUIREMENTS

- A. Glass Thickness: Select minimum thickness in accordance with ASTM E1300 to resist specified design loads.
- B. Structural Design: Design in accordance with applicable code for most critical combination of wind, snow, seismic, and dead loads.
- C. Roof Loads: Design sloped glass to resist live and dead loads.
- D. System Design: Design and size components to withstand dead loads and live loads caused by pressure and negative wind loads acting normal to plane of window.

1.3 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required. Submit solar heat gain coefficient, as well as thicknesses and tint for glass.
- C. Samples: Required.

1.4 QUALITY ASSURANCE

- A. Qualifications of Installers: Provide at least one person thoroughly trained and experienced in skills required, completely familiar with referenced standards and requirements of this work and to personally direct installation performed under this Section.
- B. Applicable Standards For Glass and Glazing Work: Conform to the "Manual of Glazing" of the Flat Glass Marketing Association, requirements of Federal Specification DD-G-451c and Safety Standard 16 CFR 1201 of the U.S. Consumer Products Safety Commission.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 - 1. Deliver glass to site in accordance with manufacturer's instructions.
 - 2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.

- B. Storage:
 - 1. Store glass in accordance with manufacturer's instructions.
 - 2. Store glass in clean, dry area indoors.
 - 3. Protect from exposure to direct sunlight and freezing temperatures.
 - 4. Apply temporary coverings loosely to allow adequate ventilation.
 - 5. Protect from contact with corrosive chemicals.
 - 6. Avoid placement of glass edge on concrete, metal, and other hard objects.
 - 7. Rest glass on clean, cushioned pads at 1/4-points.
- C. Handling:
 - 1. Handle glass in accordance with manufacturer's instructions.
 - 2. Protect glass from damage during handling and installation.
 - 3. Do not slide 1 lite of glass against another.
 - 4. Do not use sharp objects near unprotected glass.

1.6 WARRANTY

- A. Furnish five year warranty for sealed glass units.

PART 2 PRODUCTS

2.1 GLASS MATERIALS

- A. Annealed Glass: ASTM C1036, Type 1 transparent flat, Quality Q3, float glass.
- B. Heat Strengthened Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, uncoated.
- C. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, uncoated.
- D. Mirrors: Polished plate glass, No. 1 silvering quality with electrolytic copper backs; 1/4 inch thick.
- E. Provide safety glazing as required by code. Provide heat strengthened glass where required by design pressures, anticipated thermal stress, or use in spandrel areas. Provide fully tempered glass only where safety glazing is mandatory or where pressures exceed capacity of heat strengthened glass.

2.2 FLOAT GLASS PRODUCTS

- A. Clear Glass: Annealed, Heat strengthened, and Tempered float glass as specified; Class 1 clear.
- B. Tinted Glass: Annealed, Heat strengthened, and tempered float glass as specified; Class 2 tinted.
 - 1. Tint: Grey.
- C. Spandrel Frit Glass: ASTM C1048 Kind HS heat strengthened, spandrel glass on surface #4, ceramic fritted and fired, rolled. Glass tinted to match adjacent non-spandrel glazing.
- D. Minimum Thickness: 1/4 inch unless otherwise indicated.

2.3 INSULATING GLASS PRODUCTS

- A. Insulating Glass: ASTM E2190.
 - 1. Total Unit Thickness: 1 inch unless otherwise indicated.
- B. Double Pane Insulating Glass:
 - 1. Product: Solarban 60 (Solargrey + clear) manufactured by Oldcastle.
 - 2. U-Factor Winter Nighttime: 0.29 maximum.
 - 3. U factor Summer Daytime: 0.27 maximum.
 - 4. Solar Heat Gain Coefficient: 0.24 maximum.

2.4 GLAZING ACCESSORIES

- A. Provide glazing accessories required to complete glazing work, that are compatible with various components of the glazing system(s), and subject to approval of Architect.
- B. Glazing Sealants, Gaskets and Tapes: Materials compatible with adjacent materials including glass and glazing channels; type recommended by manufacturer to suit application.
- C. Setting Blocks: Silicone blocks tested for compatibility with specified glazing sealants. Provide side blocks at both jambs, between midheight and top corner of glass, at four-side conventional dry glazed openings. Side blocks are not required where glass is continuously sealed with silicone sealant at two or more edges.
- D. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings for glazing are correctly sized, within tolerance, and glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- B. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Seal porous glazing channels or recessed with substrate compatible primer or sealer.
- B. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 - 1. Glazing Sealants: Comply with ASTM C1193.
 - 2. Fire Rated Openings: Comply with NFPA 80.

- B. Install glass in accordance with manufacturer's instructions.

3.4 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass, mirrors, and adjacent surfaces.
- D. Clean glass on both sides after painting operations are complete and dry. Do not use acid solutions or caustic soaps to clean glass.
- E. Do not use razor blades to clean glass. Any scratches on the glass caused by the cleaning process will be cause for the removal and replacement of the damaged glass at the Contractor's expense.

3.5 PROTECTION

- A. Protect installed glass from damage during construction.
- B. Protect installed glass from contact with contaminating substances resulting from construction operations.
- C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal stud wall framing.
 - 2. Cementitious backer board.
 - 3. Sound partitions.
 - 4. Acoustic insulation.
 - 5. Textured finish.
 - 6. Stenciling above ceiling at fire walls.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Submit sample of wall texture for approval, before proceeding.

1.3 PROJECT CONDITIONS

- A. In cold weather, heat building to provide uniform temperature of 50 to 70 and provide ventilation to eliminate excess moisture.

1.4 SYSTEM DESCRIPTION

- A. Provide materials and installation at sound partitions noted on Drawings to achieve STC57.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. BPB Americas Inc.
 - 2. G-P Gypsum Corp.
 - 3. National Gypsum Co.
 - 4. United States Gypsum Co.
 - 5. Substitutions: Permitted.
- B. Sound Rated Partitions Components Manufacturer: PABCO or approved equal.

2.2 COMPONENTS

- A. Framing Materials:

1. Furring, Framing, and Accessories: ASTM C645; GA-216 and GA-600; galvanized sheet steel, 20 gage(33 mils) thick unless noted otherwise.
 2. Fasteners: ASTM C1002; Type S, GA-216.
 3. Adhesive: ASTM C557, GA-216.
- B. Gypsum Board Materials: ASTM C1396; Type X fire resistant where indicated on Drawings.
1. Standard Gypsum Board: 5/8 inch thick.
 2. Moisture Resistant Gypsum Board: 5/8 inch thick.
 3. Sound Deadening Gypsum Board: ASTM C208-12; Quiet Rock or approved equal.
 - a. Size: 5/8" thick; fire resistant where noted on Drawings.
 - b. STC: 57 when measured in accordance with ASTM E90.
- C. Tile Backer Board:
1. Cementitious Backing Board: High density, glass fiber reinforced, ½ inch thick.

2.3 ACCESSORIES

- A. Acoustic Insulation: ASTM C553 and C665; preformed glass fiber, unfaced.
- B. Acoustic Sealant: Quiet Seal Pro.
- C. Acoustic Putty: Quiet Putty.
- D. Casing Bead: "Goldbond" No.500 galvanized steel by National Gypsum Co., or approved equal. Furnish and install metal reveal strips where shown and detailed.
- E. Corner Beads: 0.014 inch thick, hot dip galvanized steel with 1" flanges with 1/16" radius nose with large openings in flange similar to 5/8" diameter holes 7/8" on center.
- F. Control and Expansion Joints: "Sheetrock" zinc control joint No.093 by USG, or approved equal. Provide safing and/or acoustical insulation behind control joints as required for adjacent partition construction. Use fire rated control joints in partitions requiring a fire rating.
- G. Joint Materials: ASTM C475; GA-216; reinforcing tape, joint compound, adhesive, and water.
- H. Drywall Screws: Self-drilling type, 1" long for single layer application of gypsum board to metal studs and furring channels and of longer length for multiple layer installation.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with specified requirements, manufacturer's instructions and recommendations, and referenced standards.
- B. Deliver materials to job in original unopened containers or bundles and store protected from damage and exposure to the elements.

- C. Cooperate with carpenters in placing of backing and blocking required for millwork, fixtures, fittings, and accessories.
- D. Make cut-outs in panels for pipes, fixtures and small openings. Make holes and cut-outs by method that will not fracture wallboard core or tear covering. Cut holes with accuracy so plates, escutcheons and trim cover edges.
- E. At any change in direction of gypsum board, provide sufficient auxiliary framing, blocking or nailers to allow secure attachment along every edge of every individual piece of gypsum board. Do not leave any loose edges.

3.2 INSTALLATION – FRAMING

- A. Metal Studs:
 - 1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
 - 2. Metal Stud Spacing: 16 inches o.c.
 - 3. Partition Heights: Full height to structure above unless noted otherwise. Install additional bracing for partitions extending above ceiling.
 - 4. Install bead of Quiet Seal Pro between studs and floor, walls and ceiling, at sound partitions.
- B. Ceiling Framing Installation:
 - 1. Install in accordance with GA-216 and GA-600.
 - 2. Coordinate location of hangers with other work.
 - 3. Install ceiling framing independent of walls, columns, and above ceiling work.
 - 4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
 - 5. Laterally brace entire suspension system.

3.3 INSTALLATION - GYPSUM BOARD

- A. Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions. Install acoustic sealant within partitions.
- B. Install gypsum board in accordance with GA-216 and GA-600.
- C. Fasten gypsum board to furring or framing with screws. Staples may only be used when securing first layer of double layer applications.
- D. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate course of board.
- E. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".
- F. Install Quiet Putty at electrical penetrations and outlets.

- G. Install gyp. bd. and Quiet Rock in accordance with Quiet Rock installation details, to meet STC rating at sound partitions. Refer to drawings for locations.
- H. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
- I. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- J. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts. Space between recessed boxes and cut edges shall not exceed 1/8 inches.
- K. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories described below.
- L. Cover both faces of partition framing with gypsum board in concealed spaces (above ceilings, etc.) except in chase wall which are braced internally.
- M. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.
- N. Lightly roll texture. Heavy textures are not allowed.
- O. Seal cut edges, holes, and areas where wallboard covering is broken, with water resistant sealer.

3.4 INSTALLATION - DRYWALL TRIM ACCESSORIES

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
- B. Install trim in strict accordance with manufacturers' recommendations. Install trim plumb, level, and true to line with firm attachment to supporting members.
- C. Install metal corner beads at external corners of drywall work. Corner beads are to be completely bedded and taped.
- D. Provide casing beads where edges of gypsum board meet dissimilar materials.
- E. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type

trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

- F. Install metal control joints where indicated on drawings. If not indicated on drawings, install in accordance with the following:
1. Interior Partitions: Maximum Single Dimension not to exceed 20 feet. Maximum Single Area not to exceed 400 sq. ft.
 2. Interior Ceiling With Perimeter Relief: Maximum Single Dimension not to exceed 40 feet. Maximum Single Area not to exceed 1,600 sq.ft. Install control joint at any change of direction of ceiling framing or support system.
 3. Interior Ceiling Without Perimeter Relief: Maximum Single Dimension not to exceed 20 feet. Maximum Single Area not to exceed 400 sq. ft. Install control joint at any change of direction of ceiling framing or support system.

3.5 JOINT TREATMENT AND FINISHING

- A. All joints in gypsum board construction are to be taped and floated. This includes work above ceilings, at concealed places and anywhere else joints in gypsum board construction occur.
1. All screw and/or nail heads are to be floated smooth both above and below ceiling line.
- B. Finish Levels:
1. Level 1: At Ceiling plenum areas and concealed areas.
 2. Level 2: At surfaces that are substrate for tile.
 3. Level 4 (typical Finish): At surfaces receiving light (Semi-Smooth) finishes before painting or standard wall coverings or satin/eggshell paint or flat paint.
 4. Level 5: At surfaces receiving gloss or semigloss enamels and/or other surfaces subject to severe lighting.
- C. Add stenciling for fire walls or fire barriers above ceilings as follows: Locate within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition; and include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS" or other wording.

3.6 TOLERANCES

- A. Tolerances: Maximum Variation from Flat Surface: 1/8 inch in 10 feet in any direction.

3.7 CLEANING UP

- A. Do not allow accumulation of scraps and debris arising from work of this Section. Maintain premises in neat and orderly condition at all times. Immediately remove spilled or splashed compound material and all trace of residue from adjoining surfaces.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile for floor applications.
 - 2. Porcelain and subway tile for wall application.
 - 3. Self-levelling underlayment.
 - 4. Crack suppression membrane.
 - 5. Thin-set application methods.
 - 6. Accessories.

1.2 SUBMITTALS

- A. Product Data: Required.

1.3 QUALITY ASSURANCE

- A. Tile must be from the same die lot and caliber.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Required.

1.5 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 10 sq ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 TILE PRODUCTS

- A. Porcelain Floor Tile (PT1 and PT2):
 - 1. Manufacturer: Concept Surfaces.
 - 2. Style: Divino.
 - 3. Colors: Black.
 - 4. Sizes: 12 x 24.
 - 5. Sheen: Polished and matte.
- B. Porcelain Wall and Cove Base Tile (PT3):
 - 1. Manufacturer: Dal Tile.
 - 2. Style: Portfolio.
 - 3. Color: Ice PF01.
 - 4. Size: 12 x 24 wall tile and 6 x 12 cove base

5. Finish: Matte.
- C. Subway Tile (Accent Wall Tile – Restrooms (PT4):
 1. Manufacturer: Concept Surfaces.
 2. Style: Hudson.
 3. Colors: Black.
 4. Sizes: 2 x 12.
 5. Sheen: Matte.
 - D. Picket Tile (Staff Lounge) (PT5):
 1. Manufacturer: Concept Surfaces.
 2. Style: Picket.
 3. Colors: White.
 4. Sizes: 3 x 12.
 5. Sheen: Polished.

2.2 ACCESSORIES

- A. Setting Materials: Latex-Portland Cement type: ANSI A118.4.
- B. Grout Materials:
 1. Epoxy Grout: ANSI A118.8; Fusion Pro by Custom.
- C. Cementitious Backer Board: As specified in Section 09 21 16.
- D. Tile Floor Edging: Schluter.
 1. Tile to Carpet: Schiene.
 - a. Profile Height: As required to coordinate with tile selection and setting system.
 - b. Material and Finish: Satin Anodized Aluminum.
- E. Corner Movement Joint: Schluter, DILEX – EKE; Profile with integrated rigid, recycled PVC trapezoid-perforated anchoring legs, connected at a 90-degree angle by a 3/16 inch (5 mm) wide soft CPE movement zone that forms the visible surface.
 1. Profile Height: As required to coordinate with tile selection and setting system.
 2. Movement Zone Color: As selected by Architect.
- F. Grout Sealer: Aqua Mix Sealer's Choice Gold, or approved equal.

PART 3 EXECUTION

3.1 PREPARATION

- A. Install underlayment to achieve floor flatness as required by tile manufacturer for large format tile.
- B. Install crack suppression membrane over entire floor areas that are scheduled to receive tile. Install in accordance with manufacturer's instructions and ANSI A108.17.

3.2 INSTALLATION

- A. Install tile, transitions, and grout in accordance with applicable requirements of ANSI A108.1, A108.10, and TCA Handbook recommendations. Use leveling clips to achieve 3/32" grout joints.
- B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
- C. Place edge strips (transitions) where tile flooring meets another type of flooring.
- D. Grout tile joints.
- E. Apply grout sealer after fully cleaned.
- F. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- G. Apply silicone sealant at soft joints as recommended by the TCNA.

3.3 PROTECTION

- A. Do not install walls or other building components on tile until grout has cured a minimum of 30 days.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal grid ceiling system and perimeter trim.
 - 2. Acoustic panels.
 - 3. Extruded aluminum trim for clouds.
- B. Related Sections:
 - 1. Section 09 54 23 – Linear Suspended Polymer Ceiling
 - 2. Section 09 54 26 – Suspended Linear Wood Ceilings

1.2 PERFORMANCE REQUIREMENTS

- A. Design and install suspended ceilings in accordance with requirements listed in the 2012 edition of the IBC and ASTM E580, for seismic category D.
- B. Splice Connection Strength of Main Beams, Cross Tee Intersections and Splices: 180 pounds compression and tension.
- C. Cross tees supporting light fixtures must have the same load-carrying capacity as the main beams, or be fitted with supplemental hangers.
- D. Hanger wire attachment devices: Capable of supporting minimum 100 pounds.

1.3 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Not required unless substitution.

1.4 QUALITY ASSURANCE

- A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40% during and after acoustic unit installation.

1.6 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturer's defects
 - 3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
- B. Warranty Period Humiguard:
 - 1. Acoustical panels: Ten (10) years from date of substantial completion.
 - 2. Grid: Ten (10) years from date of substantial completion.
 - 3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.

1.7 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish 50 sq ft of extra panels to Owner.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Acoustic Panels: ASTM E1264.
 - 1. Size: 24 x 24 inches.
 - 2. Thickness: 5/8 inches.
 - 3. Edge: Tegular.
 - 4. Style: Armstrong Dune or Rockfon Artic.
- B. Grid:
 - 1. Non-fire Rated Grid: ASTM C635, heavy duty; exposed T, tegular configuration.
 - 2. Grid Materials: Cold rolled steel with galvanized coating.
 - 3. Exposed Grid Surface Width: 15/16 inch with reveal.
 - 4. Grid Finish: White.
 - 5. Support Channels and Hangers: Galvanized steel, minimum 12 gage.
 - 6. Wall Moldings: Minimum 7/8".
 - 7. Provide seismic joint clip per ASTM A568 or BERC2 clip.

2.2 EXTRUDED ALUMINUM TRIM

- A. Trim: Axiom by Armstrong, or approved equal.

- B. Components: Extruded aluminum trim of commercial quality hot dipped galvanized steel coating as per ASTM A653.
- C. Finish: Exposed surfaces to be chemically cleansed, capping prefinished galvanized steel in baked polyester paint.
- D. Provide all accessories such as hanging clips, T-Bar connectors and any other trim required for a complete installation in configuration as shown on Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Suspension System:
 - 1. Install suspension system in accordance with ASTM C636 and ASTM E580, and special requirements for seismic category D.
 - 2. Coordinate location of hangers with other work. Where components prevent regular spacing of hangers, reinforce system to span extra distance. Suspension wires to have maximum 4' spacing.
 - 3. Locate system on room axis according to reflected plan. Hang system independent of wall molding, ducts, pipes and conduit.
 - 4. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths.
 - 5. Attach suspension system to two adjacent walls. Provide $\frac{3}{4}$ " clearance at opposite walls.
 - 6. Tie ends of main beams and cross tees together to prevent spreading.
 - 7. Provide positive bracing at changes in ceiling planes.
 - 8. Support and brace cable trays and electrical conduits independently.
 - 9. Provide perimeter support wires within 8".
- B. Acoustic Units:
 - 1. Fit acoustic units in place.
 - 2. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door and at restrooms.

END OF SECTION

SECTION 09 54 23

LINEAR SUSPENDED POLYMER CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes: Suspension carrier system, polymer ceiling strips, and associated accessories to provide complete Endure Linear suspended ceiling system; installed in accordance with seismic category D.

1.2 REFERENCES

- A. ASTM E84 – Surface Burning Characteristics of Building Materials; 2001.
- B. ASTM E330 – Uniform Static Air Pressure Difference – Wind Load
- C. ASTM C636 – Standard Practice for Installation of Metal Ceiling Suspension Systems
- D. ASCE 7-10; ASTM E580 – Seismic Design Category D.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Suspension System: Rigidly secure suspended ceiling system including integral mechanical and electrical components with maximum deflection of 1/360. Reference ASTM C636.
- B. Engineered polymer strips will undergo changes with variations in the environment. Therefore, all dimensional tolerances are plus or minus 1/8 inch (3 mm).
- C. Seismic suspended engineered polymer ceilings meet seismic code compliance via direct mechanical attachment to structural carriers. When installed from wall to wall it is generally exempt from seismic construction requirements such as perimeter end wall clearance, perimeter hanger wires, horizontal restraint, and vertical splay bracing. Reference ASTM E580.
- D. Fire Performance Characteristics: Suspended ceilings shall conform to Class 1, or A flame spread rating, tested according to ASTM E84; Flame Spread: 25 or less. Smoke Developed: 450 or less.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data & Warranty: Manufacturer's data sheets and supplementary information on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Removal and replacement for plenum access for maintenance and operations
- C. Shop Drawings: Provide layout of polymer ceiling and carrier system coordinated with other trades to mitigate interference. Recessed or surface mounted devices located within the ceiling panels shall also be coordinated and independently suspended per ASTM C636. Indicate method of suspension or attachment where interference exists.

- D. Verification Samples: For each finish specified, one (1) sample, 12" (305mm) wide x 12" (305mm) long shall be submitted for approval representing actual product, color, and patterns.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment and periodic cleaning and maintenance of all components.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Minimum 2 years documented experience installing projects of similar size and complexity.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in the manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store products off the floor in manufacturer's unopened packaging protected from exposure to harmful environmental conditions and at temperature and humidity conditions as recommended by the manufacturer.
- C. A minimum of 12 hours prior to ceiling installation, engineered polymer ceilings shall be stored in the area in which they will be installed. Temperature and humidity of the area during this period shall closely approximate those conditions that will exist when the building is occupied.
- D. Handle materials carefully to avoid damage.

1.7 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 WARRANTY

- A. Manufacturer: All materials supplied by the ceiling manufacturer shall be guaranteed against manufacturing defects for one (1) year. Due to differing site conditions, finishes can vary with age and are excluded from this warranty.

1.9 COORDINATION

- A. Coordinate layout and installation of the engineered polymer ceilings with other work penetrating the ceiling including light fixtures, HVAC equipment, and fire suppression system components. Refer to manufacturer's hosted submittal site for typical details.

1.10 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements.

- B. Deliver materials for Owner's use in maintenance.
 - 1. Provide 5-10 percent of each type installed for use by owner in building maintenance and repair.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Rulon International, 2000 Ring Way Rd.; St Augustine, FL 32092; Tel: 800-227-8566; Tel: 904-584-1400; Fax: 904-584-1499; Email: nationalaccounts@rulonco.com; Web: rulonco.com
- B. Substitutions: In accordance with Section 01 60 00.

2.2 MATERIALS - GENERAL

- A. Engineered polymer will expand or contract slightly with temperature changes and therefore all dimensional tolerances are plus or minus 1/8 inch (3 mm).

2.3 ENDURE LINEAR ENGINEERED POLYMER SUSPENDED CEILING SYSTEM

- A. Engineered polymer ceiling strips are made with an engineered polymer core and can be furnished in solid colors or with a woodgrain or metallic film applied to the face. Engineered polymer strips are nearly inert to harsh, moist weather conditions. Strips are completely recyclable and UV resistant.
 - 1. 900 Series Engineered Polymer Strips:
 - a. Ceiling pans are provided with integral spacers between the edges of each strip, with the flat face visible.
 - b. Ceiling pans are 3-1/4 inches (83 mm) wide with an integral 3/4 inch (19 mm) spacer and placed into a design module of 4 inches (102 mm) with square sides.
 - 2. Trim and Border Treatment: Provide perimeter trim and expansion joints as needed.
 - 3. Finish:
 - a. As selected by the Architect or Interior Designer from the manufacturer's standard selections.

2.4 ACCESSORIES

- A. System Carriers: Only use system carriers that are supplied by the same manufacturer supplying the engineered polymer ceiling system to ensure compatibility. Carriers may be suspended or direct-screwed.
- B. Matching Trim: Only use matching trim supplied by the same manufacturer of the engineered polymer system to ensure compatibility in fit and color.
- C. Access Hatches: Refer to detail on Drawings.

2.5 SUSPENSION SYSTEMS

- A. System Carriers: Endure Powder Coated Galvanized Carriers, installed 6 inches from perimeter and maximum 2 feet on center.
 - 1. Suspend via hanger wire in accordance with ASTM C636 or directly attach carriers to structure or framing.

2.6 FABRICATION

- A. Edges, borders, and perimeter trims shall be indicated on the Drawings in accordance with the manufacturer's standard design details.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that suspension carriers are in place, suspended and leveled in a direction perpendicular to the strip direction of the engineered polymer ceiling.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction, including the following:
 - 1. Comply with ASTM C636 and seismic design requirements indicated.
 - 2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 3. Additional Hanger Wires: Wrapped tightly 3 full turns to structure and component at locations where imposed loads could cause deflection exceeding 1/360 span or tolerances specified below.
 - 4. Install vertical struts in accordance with manufacturer's shop drawings.
 - 5. Install in accordance with seismic category D.
- B. Perimeters: Use a laser leveling device to lay out and install the perimeter trim as specified.
- C. Vertical Struts: Where struts are required, vertical struts shall be installed maximum 6 inches from each end and no greater than 3 feet on center.
- D. Direct Attach: Carriers may be direct attached to structure .
- E. Engineered Polymer Strips: Strips shall be fully attached to the carrier by snapping one side of the strip into position first, followed by the second side. When properly installed, the strips shall be firmly secured, and fully level. If applicable, end cuts are butted tight together by snapping a connector behind the strips to create a secure, aligned joint.
- F. Install access panels were indicated in accordance with manufacturer's recommendations
- G. Make final adjustments to level or contours as required.

3.3 FIELD QUALITY CONTROL

- A. Technical Service: Manufacturer shall provide installation instructions and support via video conference there needed.
- B. Upon completion of ceiling installation, the owner's representative shall inspect all finished surfaces to ensure that the work has been completed in a manner satisfactory to the owner. Any deficiencies in the install of the ceiling shall be corrected prior to substantial completion.

3.4 ADJUSTMENTS AND CLEANING

- A. Clean exposed surfaces of ceiling panel in accordance with manufacturer's instructions.
- B. Remove and replace engineered polymer strips, which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 54 26

SUSPENDED LINEAR WOOD CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Linear Open Ceiling Panels
- B. Suspension Systems

1.2 REFERENCES

- A. ASTM E 84 - Title; 2001.
- B. FSC STD-01-001 - FSC Principles and Criteria for Forest Stewardship
- C. FSC STD-40-004 - FSC Standard for Chain of Custody Certification

1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1:360.
- B. Wood is a natural product that will undergo changes with variations in the environment. Therefore, all dimensional tolerances are plus or minus 1/8 inch (3 mm).
- C. Seismic Suspended wood ceilings meet seismic code compliance via direct screw attachment to heavy duty grid. Local code requirements should be consulted in order to determine additional requirements.
- D. Fire Performance Characteristics: Suspended wood ceilings shall conform to Class 1, or A flame spread rating, tested according to ASTM E 84; Flame Spread: 25 or less. Smoke Developed: 450 or less.
- E. Certified Wood: Suspended wood ceilings shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification"

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide layout of suspended wood ceiling and T-rails coordinated with other trades that will penetrate the wood ceiling or interfere with the installation and recessed or surface mounted devices located within the ceiling panels. Indicate method of suspension where interference exists.

- D. Verification Samples: For each finish product specified, one sample, minimum size 12 inches (305 mm) square, representing actual product, color, and patterns.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment and periodic cleaning and maintenance of all components.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Minimum 2 years documented experience installing projects of similar size and complexity.
- C. Provide seismic design of suspended ceiling under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in the manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store products off the floor in manufacturer's unopened packaging protected from exposure to harmful environmental conditions and at temperature and humidity conditions as recommended by the manufacturer.
- C. A minimum of 72 hours prior to ceiling installation, suspended wood ceilings shall be stored in the room in which they will be installed. Temperature and humidity of the room during this period shall closely approximate those conditions that will exist when the building is occupied.
- D. Handle materials to avoid damage.

1.7 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Plenums have proper ventilation, especially in high moisture areas with no excessive buildup of heat in the ceiling areas.
- C. Space shall be fully enclosed with all exterior windows and doors in place, glazed, and weather-stripped. Roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry.
- D. Mechanical, electrical, and other utility services above the ceiling plane shall be completed. No

materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.

- E. Install only when the temperature and humidity closely approximate the interior conditions that will exist when the building is occupied. Heating and cooling systems shall be operating before, during, and after installation, with the humidity of the interior spaces maintained between 25 and 55 percent, and a temperature between 60 to 90 degrees F.

1.9 COORDINATION

- A. Coordinate layout and installation of the wood slats ceiling systems with other work penetrating the ceiling including light fixtures, HVAC equipment, and fire suppression system components.

1.10 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements.
- B. Deliver materials for Owner's use in maintenance.
 - 1. Provide ___ percent of each type actually installed for use by owner in building maintenance and repair.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Rulon International, which is located at: 2000 Ring Way Rd.; St Augustine, FL 32092; Toll Free Tel: 800-227-8566; Tel: 904-584-1400; Fax: 904-584-1499; Email: nationalaccounts@rulonco.com; Web: rulonco.com
- B. Substitutions: Refer to Section 01 60 00.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS - GENERAL

- A. Wood is a natural product that will undergo changes with variations in the environment. Therefore, all dimensional tolerances are plus or minus 1/8 inch (3 mm).

2.3 LINEAR CEILING PANELS

- A. Linear Open Style: Provided in random lengths with tongue and groove ends or in fixed lengths. Standard lengths are 3 feet to 10 feet.
 - 1. Module Size:
 - a. 6 inch (152 mm) module, having wood strips 3/4 inch (19 mm) thick by 5-1/4 inch (133 mm) wide, and a 3/4 inch (19 mm) reveal
 - 2. Location:
 - a. Interior Areas: Interior ceiling areas shall have a factory-installed fiberfelt spacer between the wood strips. Fiberfelt spacer is provided in a standard black color.
 - 3. Trim and Border Treatment: Provide end caps or junction trims as indicated.
 - 4. Wood Species: Ash.
 - 5. Finish: Custom stain to match wood doors

2.4 ACCESSORIES

- A. Cliprail: Attachment clips are spring-steel with phosphate pre-treatment and corrosion-resistant coating and are attached at pre-spaced intervals to heavy-duty grid.

2.5 SUSPENSION SYSTEMS

- A. Main Tees: Standard heavy duty 15/16 inch (24 mm) T-rail specified in Section 09 22 26 - Suspension Systems.
- B. Hangers: Suspend ceiling panels from T-rail using torsion springs, C-hangers, or direct screw attachment, as recommended by the manufacturer.
 - 1. System for Linear 4.5 inch open, 6 inch open, and 4 inch closed shall consist of Rulon cliprails, installed on #12-gauge wire hangers.
 - 2. Linear wood system cliprail shall use clips factory-attached to the main tees, factory indexed to maintain the specified module.

2.6 FABRICATION

- A. Edges, borders, and perimeter trims shall be indicated on the Drawings in accordance with the manufacturer's standard design details. All suspended wood ceiling products specified shall be supplied by the wood slat ceiling manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that T-rail carriers are in place, suspended and leveled in a direction perpendicular to the wooden strip direction of the wood panels.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Work shall not begin until the space is fully enclosed and glazed and all wet work is completed and dried out to the satisfaction manufacturer.
- C. Temperature shall be at least 65 degrees Fahrenheit during the installation and thereafter.
- D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction, including the following:
 - 1. Comply with ASTM C 636 and seismic design requirements indicated.
 - 2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

- 3. Additional Hanger Wires: Wrapped tightly 3 full turns to structure and component at locations where imposed loads could cause deflection exceeding 1/360 span or tolerances specified below.
 - B. Use a laser leveling device to lay out and install the perimeter trim as specified.
 - C. Suspend wood slats from the cliprail system using integrated linear clips.
 - D. Make final adjustments to level or contours as required.
- 3.4 FIELD QUALITY CONTROL
- A. Technical Service: Manufacturer shall provide a local Technical Service Representative for on-site training and assistance during the installation process.
 - B. Environmental Monitoring: Manufacturer shall provide a temperature and humidity sensor to actively monitor the room in which the wood slats shall be installed for a minimum of one week before and up to two weeks after installation has been completed including all of the weeks in between.
 - C. Upon completion of ceiling installation, the owner's representative shall inspect all finished surfaces to ensure that the work has been completed in a manner satisfactory to the owner. Any deficiencies in the install of the ceiling shall be corrected prior to substantial completion.
- 3.5 ADJUSTMENTS AND CLEANING
- A. Clean exposed surfaces of ceiling panel in accordance with manufacturer's instructions.
 - B. Remove and replace panels and tiles, which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- 3.6 PROTECTION
- A. Protect installed products until completion of project.
 - B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient tile flooring.
 - 2. Resilient molded rubber base.
 - 3. Resilient rubber cove base.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Required.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.5 WARRANTY

- A. Provide manufacturer's 20 year commercial warranty for Luxury Vinyl Tile.

PART 2 PRODUCTS

2.1 LUXURY VINYL PLANK FLOORING

- A. Manufacturer: Mannington.
 - 1. Style/Color: Abstract/Forsyth.
 - 2. Size: 18" x 18".

2.2 RESILIENT BASE

- A. Molded Rubber Base:
 - 1. Manufacturer/Style: Tarkett.
 - 2. Style: Reveal.
 - 3. Color: #21 Platinum.
 - 4. Size: 6".

- B. Rubber Cove Base:
 - 1. Manufacturer: Tarkett.
 - 2. Color: Platinum #23.
 - 3. Size: 4".

2.2 ACCESSORIES

- A. Resilient Edge Strip (at carpet/LVT junctures): Tandus Centiva, ME-001 Metal Edge UN.
 - 1. Color: 00178 Ironstone.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify concrete floors are dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

3.2 PREPARATION

- A. Clean substrate.
- B. Fill minor low spots and other defects with sub-floor filler.
- C. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.
- D. Beginning of installation constitutes acceptance of subfloor.

3.3 INSTALLATION

- A. Install luxury vinyl flooring in accordance with manufacturers' instructions. Install with adhesive recommended by flooring manufacturer.
- B. Install edge strips where flooring terminates. Float up as required to provide smooth transition at tile junctures.

3.4 INSTALLATION - BASE

- A. Fit joints tightly and make vertical.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

3.5 CLEANING

- A. Remove excess adhesive from surfaces without damage.
- B. Do not wash the floor for at least four to five days after installation.

END OF SECTION

SECTION 09 68 15

PLANK CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes carpet planks and accessories, fully adhered.

1.2 REFERENCES

- A. Carpet and Rug Institute:
 - 1. CRI 104 - Standard for Installation of Commercial Carpet.
 - 2. CRI Green Label Plus Testing Program.
- B. Consumer Products Safety Commission:
 - 1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.
- C. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location of edge moldings.
- C. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.5 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Comply with one of the following:
 - a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
 - b. CPSC 16 CFR 1630.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Store materials in area of installation for 48 hours prior to installation.

1.8 WARRANTY

- A. Furnish the following manufacturer warranties:
 - 1. Lifetime of Carpet: No More than 10% face yarn loss by weight in normal use.
 - 2. Static: Lifetime of Carpet.
 - 3. Edge Ravel: Lifetime of Carpet. Guaranteed no edge ravel in normal use (no seam sealers required)
 - 4. Delamination: Lifetime of Carpet. Guaranteed no delamination in normal use.
 - 5. Tuft Bind: Lifetime of Carpet. Guaranteed not to zipper, wet or dry.
- B. Submit installer's two year warranty to correct or replace all defects in workmanship.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 5% of carpet planks of each color and pattern selected.

PART 2 PRODUCTS

2.1 CARPET TILE

- A. Manufacturer: Patcraft.
 - 1. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Carpet Tile:
 - 1. Plank Size: 12 x 48 nominal.
 - 2. Pattern: Etched.
 - 3. Color: Renewed Element 00512.

2.3 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by flooring material manufacturer.
- B. Moldings and Edge Strips: Refer to Section 09 65 00.
- C. Adhesive: Type recommended by carpet manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

- B. Verify floor surfaces are smooth and flat within tolerances required by carpet manufacturer, and are ready to receive work. Beginning of work constitutes acceptance of conditions.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Clean substrate.

3.3 INSTALLATION

- A. Install carpet planks in accordance with manufacturer's instructions and CRI 104.
- B. Do not mix carpet from different cartons unless from same dye lot.
- C. Cut carpet planks clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- D. Install carpet planks in ashlar pattern, with pile direction parallel to next unit, aligned as indicated on shop drawings.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet planks.
- G. Trim carpet planks neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 72 00

WALL COVERINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Surface preparation.
 - 2. Wall covering.
- B. Related Sections:
 - 1. Section 09 90 00: Primer.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturer, Pattern and Color:
 - 1. Private Restroom: MDC Tipping Point, Silver Spill
- B. Adhesive: Type recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify walls have been primed. Do not apply wall covering over bare gyp. Bd.

3.2 INSTALLATION

- A. Apply wallcovering smooth, without wrinkles, gaps or overlaps. Apply in accordance with manufacturer's recommendations.
- B. Horizontal seams are not acceptable.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data on products.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

- F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.6 SEQUENCING

- A. Sequence application to the following:
 - 1. Do not apply finish coats until paintable sealant is applied.
 - 2. Back prime wood trim before installation of trim.

1.7 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 1 gallon of each color, type, and surface texture; store where directed.
- C. Label each container with color, type, texture, room locations, in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Manufacturers:
 - 1. Benjamin Moore
 - 2. Farrell Calhoun.
 - 3. PPG Architectural Finishes.
 - 4. Sherwin Williams.
 - 5. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
 - 1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
 - 2. For good flow and brushing properties.
 - 3. Capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
- C. Patching Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive Work as instructed by product manufacturer.

- C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

- A. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by [hand] [power tool] wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- I. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- J. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- K. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- L. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- C. Sand wood and metal surfaces lightly between coats to achieve required finish.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- F. Prime concealed surfaces of woodwork with primer paint.
- G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- H. Finishing Mechanical and Electrical Equipment:
 - 1. Refer to mechanical and electrical sections for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
 - 2. Paint shop primed equipment.
 - 3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
 - 5. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.
 - 6. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - 8. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated..
 - 9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Paint exposed lintels, gas piping, and any other exposed metals on the exterior.
- B. Paint exposed surfaces of stringers, exposed vertical risers, and elevator pit ladder.

3.6 SCHEDULE - EXTERIOR SURFACES

- A. Pavement Markings: Refer to civil specifications.
- B. Concrete, Concrete Block:
 - 1. One coat of heavy duty block filler.
 - 2. Two coats of latex enamel, sprayed then rolled to achieve solid coverage with no "pin holes".
- C. Steel - Unprimed:
 - 1. One coat of latex primer.
 - 2. Two coats of latex enamel, semi-gloss.
- D. Steel - Shop Primed:
 - 1. Touch-up with zinc chromate primer.
 - 2. Two coats of latex enamel, semi-gloss.
- E. Steel - Galvanized:
 - 1. One coat galvanize primer.
 - 2. Two coats of latex enamel, semi-gloss.

3.8 SCHEDULE - INTERIOR SURFACES

- A. Wood - Painted:
 - 1. One coat of alkyd prime sealer.
 - 2. Two coats of alkyd enamel, semi-gloss.
- B. Wood - Transparent:
 - 1. Filler coat (for open grained wood only).
 - 2. One coat of stain.
 - 3. One coat of sealer.
 - 4. Two coats of varnish, gloss.
- C. Steel - Unprimed:
 - 1. One coat of latex enamel primer.
 - 2. Two coats of latex enamel, semi-gloss.
- D. Steel - Primed:
 - 1. Touch-up with latex enamel primer.
 - 2. Two coats of latex enamel, semi-gloss.
- E. Steel - Galvanized:
 - 1. Touch-up with one coat of galvanize primer.
 - 2. Two coats of latex enamel, semi-gloss.
- F. Gypsum Board Walls:
 - 1. One coat of latex primer sealer.
 - 2. Two coats of latex acrylic enamel, satin.
- G. Gypsum Board Walls to Receive Vinyl Wallcovering:
 - 1. One coat latex primer sealer.

- H. Gypsum Board Ceilings:
 - 1. One coat of latex primer sealer.
 - 2. Two coats of latex acrylic enamel, eggshell.

3.7 SCHEDULE – COLORS

- A. Main Wall Paint: SW 7064 Passive.
- B. Office Wall Paint: SW7066 Gray Matters
- C. Accent Paint: Match FCB PMS blue.
- D. Wave Wall: White.

END OF SECTION

SECTION 10 00 00

SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rapid entry system.

1.2 SUBMITTALS

- A. Product Data: Required.

PART 2 PRODUCTS

2.1 RAPID ENTRY SYSTEM

- A. Provide a knox box with tamper proof switch, dark bronze finish, recessed mounted.

PART 3 EXECUTION

3.1 INSTALLATION – KNOX BOX

- A. Install knox box on the exterior wall, in location satisfactory to the Fire Marshall.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Interior restroom signs. Exterior signs are N.I.C.
 - 2. Vinyl letters/numbers.
- B. Related Sections:
 - 1. Section 23 01 90 - Mechanical Identification

1.2 REFERENCES

- A. Conform to the following:
 - 1. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336, (ADA).
 - 2. ANSI A117.1: Providing Accessibility and Useability for Physically Handicap People, 1986 edition.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit color chips (photos of colors are not acceptable) for selection by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Package signs, labeled in name groups.
- C. Store adhesive attachment tape at ambient room temperatures.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install signs when ambient temperature is lower than recommended by manufacturer.
- C. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 INTERIOR SIGNS

- A. Manufacturers:
 - 1. ASI Sign Systems.
 - 2. DFI
 - 3. Archway Graphics
 - 4. Mohawk
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Signs: Clear Acrylic Face, in matte (non-glare) finish.
 - 1. Backing Plate: Acrylic.
 - 2. Sign Color: As selected by Architect.
 - 3. Character Color: Mohawk, 113 Grey or approved equal.
 - 4. Height: As required to fit on sign.
 - 5. Edges: Radiused.
 - 6. Character Font: Helvetica.
 - 7. Provide braille to meet ADA.
- C. Restroom Signs:
 - 1. Description: HC symbol, message with Braille.
 - 2. Approximate Size: 8" x 8"
 - 3. Quantity: At each restroom.

2.2 VINYL LETTERS/ NUMBERS

- A. Provide 6" high vinyl numbers with the address on the glass over entry doors, and at Community Room entry, as shown on Drawings.

2.3 ACCESSORIES

- A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install signs and letters after surfaces are finished, in locations as directed by Architect/Engineer.
- B. Position restroom sign on strike side of door. Position sign 60 inches above the finished floor to the centerline of the sign.
- C. Locate sign on wall surface, level.

END OF SECTION

SECTION 10 22 17

MODULAR PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular partitions framing.
 - 2. Glass and glazing.
 - 4. Doors.
 - 5. Accessories.
 - 6. Finishes.
- B. Related Sections:
 - 1. Section 08 80 00: Glazing.
 - 2. Section 08 71 00: Door Hardware.
 - 3. Section 08 41 13: Aluminum Storefront and Entrances.
 - 4. Section 08 11 25: Interior Aluminum Frames.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA): AAMA 61198 Voluntary Standards for Anodized Architectural Aluminum.
- B. ASTM International:
 - 1. ASTM E72 Method for Conducting Strength Tests of Panels for Building Construction.
 - 2. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E90 Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 4. ASTM E413 Classification for Rating Sound Insulation.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Modular partitions shall be capable of withstanding the effects of gravity loads, dead loads, and the following loads and stresses within limits and under conditions indicated:
 - 1. Transverse Load: Lateral deflection of the overall span when tested under a uniformly distributed load of 5 psf (0.24 kN/m²) in accordance with ASTM E72 where L = modular partition wall height:
 - a. Glass Walls: Not more than L/175 or 3/4 inch (19 mm) which ever is more stringent.
 - 2. Mechanical Strength: Capable of withstanding static loads in accordance with ANSI/BIFMA X5.6.
 - 3. Seismic Performance: Provide modular partitions capable of withstanding effects of seismic motions determined according to the currently adopted building codes.
- B. Fire Resistance:
 - 1. Surface-Burning Characteristics: Tested in accordance with ASTM E84 by a qualified independent testing agency.

- C. Coordination Requirements:
1. Comply with Division 01 project management and procedures.
 2. Project Scheduling and Lead Times: Manufacturing production time of all standard products and finishes shall not exceed five weeks, inclusive of shipping within US and Canada, from manufacturer's receipt of complete order information (including shop drawing approval, deposit cost, and notice to proceed).
 3. Schedule: Coordinate delivery with construction schedule to avoid storage or double handling of the modular partition system.
 4. Install modular partition system after the building is enclosed and conditioned including completion of HVAC equipment, fire suppression system, lighting, adjacent ceilings and base building finishes in a sequence that allows final electrical connection, voice data/communications to be completed during or after installation of the modular partition systems.
 - a. Coordinate modular partition installation with ceiling, floor finish, and specified wall base (modular partition standard base, applied base, or integral base installation).
 5. Floor and base finishes may be completed before installation of modular partition system unless coordinated with the manufacturer ahead of time through the Shop Drawing process.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturers standard product information for each type of product indicated.
- B. Shop Drawings:
1. Provide manufacturer's architectural plans, elevations, sections, connection and attachment details, finish schedule, reflected ceiling plans, doors and hardware schedule, electrical and mechanical requirements, schedules, and locations.
 2. Provide manufacturer with product data, fabrication drawings, schematics and similar information for data, security, or communications to be embedded within or supported by modular partitions.
 3. Include field measurements of existing construction, future construction, finished width and height of partitions and associated components.
 - a. Manufacturer's authorized representative shall undertake field measurements to show relevant adjacencies in Shop Drawings. Site conditions, base building construction, and required clearances are to be reviewed and approved by the Architect, including exiting, life safety, location of building service devices, and other affected trades through Shop Drawings to identify and prevent potential conflicts.
 - b. Where field measurements are not possible, hold-to and control dimensions must be coordinated and agreed upon by all parties through the Shop Drawing process before manufacturing begins.
- C. Coordination Drawings:
1. Provide shop drawings for coordination between trades upon request.
 2. Provide architectural plans locating modular partitions within the base building, including finishes and construction of surfaces the modular partition system will interface with or connect to.
 3. Electrical: Coordinate electrical components with final circuited electrical engineering documents.

- D. Samples: Provide manufactures standard size samples for verification of support system and each type, color, and texture of exposed finish, full thickness and the following minimum sizes:
 - 1. Extrusion Components.
 - 2. Linear Trim and Base.
 - 3. Door Face Finishes.
 - 4. Glazing.
- E. Provide product data sheets for all types of Hardware and Accessories.
- F. Maintenance Data: Provide maintenance data for incorporation into operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Manufacturer shall specialize in designing and manufacturing modular partitions of the quality and complexity required for this project with a minimum of 10 years documented successful experience. Manufacturer shall have production facilities capable of meeting contract requirements for single-source responsibilities and warranty.
 - 2. Installer Qualifications: Certified by the manufacturer.
- B. Pre-Installation Conference:
 - 1. Meet at the project site minimum 1 week prior to Shop Drawing approval and prior to beginning installation. Meeting shall include authorized representatives of the Owner, Architect, base building contractor and all trades whose work will interface with installed systems.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver or install modular partitions until spaces are enclosed and weather-tight, wet work is complete and dry, work above ceilings is complete, and HVAC system is operational and able to maintain ambient temperature and humidity conditions at occupancy levels for the remainder of the construction period.
- B. Ship system components in manufacturer's standard packaging. Maintain air circulation during shipment. Do not allow packaging to get wet or develop condensation.
- C. Deliver materials to project site or offsite warehouse as directed by the Contractor or Owner as applicable, and in accordance with the manufacturer's instructions in original unopened and undamaged packages. Packages shall be labeled with manufacturers name, brand names, size, finishes, and placement locations.
- D. Store in a clean, dry, secure space to protect from damage during construction activities. Minimize or eliminate storage period by coordinating with construction schedule.
- E. Handle in accordance with the manufacturers instructions.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install system and components until building is enclosed and finishing operations are complete, including adjacent ceiling and floor covering installation and painting.

- B. Temperature and humidity shall be maintained to final occupancy standards. Installation areas shall be climate controlled between 60 and 90 degrees F (15.5 and 32.2 C) with Relative Humidity maintained between 25 and 55 percent.

1.8 WARRANTY

- A. Provide manufacturers standard, limited, transferable warranty executed in the name of the Owner. Guarantee the site assembled modular structure, panel system and components are free from defects in material and workmanship.
 - 1. Warranty Period, Modular Partition System: 10 year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. DIRT Environmental Solutions; www.dirtt.net.
- B. Substitutions: Not permitted without demonstrating compliance with aesthetic effects shown in the drawings, performance requirements and lead times specified above. Refer to Section 01 60 00.

2.2 SYSTEM DESCRIPTION

- A. Factory assembled, site installed, moveable, demountable, reusable interior solid and glazed partitions, including structure, face mounted finished tiles, modular and non-modular metal framing and doors to accept a variety of millwork, finishes, building services components, technology, and accessories.
- B. System is floor-supported, floor-to-ceiling site constructed in configurations shown on the Shop Drawings. Top channels hold modular partitions in place and accommodate height adjustments to suit floor-to-ceiling dimensional variations and similar site specific requirements.
 - 1. Where modular partitions are not clipped to ceilings or other overhead construction, additional structural review and system engineering will be required by the manufacturer.
- C. Partially Unitized Solid Wall system shall be comprised of modular components which can be disassembled, relocated / field cut and substantially reused.

2.3 MODULAR PARTITIONS FRAMING

- A. Framing for Glazed Partitions:
 - 1. Material: Aluminum extrusions, 6063T6 aluminum alloy, thickness engineered to meet performance requirements specified above.
 - 2. Vertical Support Spacing: 6 inch (150 mm) minimum to 48 inch (1219 mm) maximum.
 - 3. Ceiling Track: Continuous, with intermittent breaks for pass through of building services or structural components.
 - 4. Floor Track: Modular with wall frames inclusive of carpet grippers or floor tape (non-seismic) or continuous with floor anchor attachment (seismic) stopped at doorways and pass-throughs.
 - 5. Bracing: As required to meet structural performance.
 - 6. Fasteners: Zinc Plated Steel Type F Screws unless otherwise indicated on engineered shop drawings.

- B. Frame Bases:
 - 1. Provide frame bases with provisions for 1-1/2 inch (38.1 mm) height adjustment to accommodate floor slab variances.
 - 2. Provide a leveling mechanism for making fine adjustment in height over adjustment range of the product.

2.4 GLASS AND GLAZING

- A. Typical: Tempered glass minimum thickness 6 mm (1/4 inch) to ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type 1, Class 1 (transparent), Quality q3.
- B. Laminated Glass: To ASTM C1172, Kind LA fabricated from two nominal 3 mm (1/8 inch) pieces of Type 1, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036.

2.6 DOORS AND DOOR HARDWARE

- A. General:
 - 1. Coordinate security system components to be provided by others with Modular partitions manufacturer through the Shop Drawing process.
- B. Hardware: Manufacturer's standard hardware as follows:
 - 1. Entry Vestibule and 2nd Floor Conference Room: 72" Pulls 56" C to C 1" dia. (Satin Stainless), CRL Top & Bottom Rails DR2SSA12C, CRL Bottom Pivots 1NT403, DIRT Jackson Concealed Door Closer with 90 degree hold open (Concealed within and mounted to frame header) 20-106M-20, Top Closer Inserts CRL 1NT703, CRL Dust Proof Keeper (AMR208BN), DIRT Wall Stops (626). Refer also to Section 087100.
 - 2. Entry Vestibule to 1st Floor Conference Room: 72" Pulls 56" C to C 1" dia. (Satin Stainless), CRL Top & Bottom Rails DR2SSA12C, CRL Bottom Pivots 1NT403, DIRT Jackson Concealed Door Closer with 90 degree hold open (Concealed within and mounted to frame header) 20-106M-20, Top Closer Inserts CRL 1NT703, CRL Dust Proof Keeper (AMR208BN), DIRT Wall Stops (626), and Schlage M420 mag lock with single gang wall box with conduit.
 - 3. Offices, Staff Lounge, and All Others Not Listed Herein: 30" Pull 24" C to C 1" Dia. (Satin Stainless), CRL Top Rail DR2SSA12C, CRL Bottom Pivot 1NT403, DIRT Jackson Concealed Door Closer with 90 degree hold open (Concealed within and mounted to frame header) 20-106M-20, Top Closer Inserts CRL 1NT703, CRL Dust Proof Keeper (AMR208BN), DIRT Wall Stops (626). Refer also to Section 087100.
- C. Hardware Reinforcement: Factory milled by modular partition manufacturer to suit glass and hardware supplied by others as shown on shop drawings.
 - 1. Security System Components: Coordinate security system requirements and components to be provided by others with modular partitions manufacturer through the shop drawing process.
- D. Frameless Glass Pivot Door: Specified glass with top rail and bottom aluminum rails supplied locally by others.
 - 1. Door Glazing: 3/8 inch (10 mm) tempered glass supplied locally by others.
 - 2. Stile Width: None.
 - 3. Top Rail Height: 2-15/16 inch (61 mm).
 - 4. Bottom Rail: 10 inches.

5. Hardware Reinforcement: Factory milled by modular partition manufacturer to suit glass and hardware supplied by others as shown on show drawings.
6. Security System Components: Coordinate security system requirements and components to be provided by others with modular partitions manufacturer through the shop drawing process.

2.7 DOOR FRAMES

- A. Pivot Door Frames: Manufacturer's standard aluminum frame **single door**, reversible, factory milled to receive hardware for 1-15/32" doors.
 1. Door Module Size: As scheduled.
 - a. Finished door width is equal to module width less 2 inches.
 2. Configuration: Header, jambs and pivot hardware. Single door frame width not to exceed 44 inch wide module.
 3. Hardware Preparation and Reinforcement: Milled, reinforce, drill and tap frames at factory to receive specified hardware in accordance with the contract hardware schedule and templates.
 4. Frame Height: Jambs shipped over length (height) by 51 mm (2 inches) in height, for field cutting to suit opening height for proper alignment with adjacent frames.
 5. Frame Preparation: Factory milled frame with hinge locations and sizes as determined by manufacturer.
 6. Factory notched and drilled jambs for ceiling track, and manufacturer's standard header attachments.
 7. Extrusion Profile: Rectilinear profile to match any adjacent unitized glass frames.
 8. Seals: Manufacturer's standard.

2.8 ACCESSORIES

- A. Connections and Supports: Manufacturer's standard connections and supports that connect and release from floor and ceiling without damage using carpet grippers and ceiling track clips, with exception of the following conditions: Bulkhead (drywall ceiling), seismic conditions, electrical or service feeds, physical connections to base building (where required).
- B. Panel Joint Closure: Manufacturer's standard, capable of closing up to a 25 mm (1 inch) gap between demountable partitions and base building elements.
- C. Trim: Continuous and modular, factory finished, snap on type; field cuttable for variations in floor and ceiling levels.
 1. Base Trim Profiles: Recessed; removable to access leveling mechanisms.
 2. Ceiling Trim Profile: Recessed; adjustable to accommodate up to a 12 mm (1/2 inch) gap between demountable partitions and base building elements.
 3. Wall Trim Profile: Recessed; adjustable to accommodate up to a 12 mm (1/2 inch) up to 25 mm (1 inch) gap between demountable partitions and base building elements.
 4. Colours: As selected by Architect from manufacturer's full range.

2.9 FABRICATION

- A. Components:
 1. Fabricate components for installation with concealed fastening devices and pressurefit members that will not damage ceiling or floor coverings. Exceptions: Drywall ceiling, seismic applications and doors against base building require screw holes in base building

- for proper fastening.
- 2. Fabricate for installation with manufacturer's standard seals at floor and other locations where partition assemblies abut fixed construction and for installation of sound attenuation insulation in partition cavities.

2.10 FINISHES

- A. Protect finishes on exposed surfaces from damage during shipping.
- B. Appearance of Finished Work: Finishes shall match approved samples.
- C. Frame Finishes: Clear Anodized Aluminum: AAMA 611, AAM12C22A31, Class I.
- D. Door Finishes: Clear anodized aluminum; AAMA 611, AAM12C22A31, Class I.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field or hold-to control dimensions before fabrication of modular partitions. Coordinate fabrication schedule with construction schedule and progress to avoid delay in the work.
- B. Examine all adjoining work including work by others. Do not proceed with fabrication or installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Locations to receive modular partitions shall be inspected for compliance with manufacturer's requirements.
- B. Site floor conditions must be surveyed to determine the nature of floor level and determine where special conditions exist beyond manufacturer's standard leveling capabilities of 1-1/2 inch in 4'-0" (38.1 mm in 1219 mm).
- C. Field conditions and pre-existing installations by others which may adversely affect installation or exceed the manufacturer's limitations shall be corrected before installing modular partitions.

3.3 INSTALLATION (TYPICAL PROCESS)

- A. Installation of modular partitions system shall be completed by a manufacturer certified installer.
- B. Install system level, plumb, and aligned.
- C. All building services shall be installed and connected to the base building systems by licensed sub trades. All building services shall be inspected by authorized trade representatives and Authority Having Jurisdiction in the presence of a manufacturer representative. Coordinate with all affected parties as required.
- D. Installation sequence as determined by the certified installer and coordinated with the General Contractor based on project conditions.

3.4 CLEANING

- A. Upon completion of installation, modular partition components and finishes shall be cleaned in accordance with the finish manufacturer's instructions. Alkaline or abrasive agents shall not be used. Avoid scratching or marring finishes.

3.5 PROTECTION

- A. Protect from damage through the duration of construction activities.

3.6 DEMONSTRATION / TRAINING

- A. Manufacturer's Distribution Partner will be responsible to provide general product training to the Owner or their outsourced operations team at time of installation as well as conduct a comprehensive training session(s) to convey the methodology, and assembly of the modular partitions to sustain general operational maintenance by the Owner's personnel with clearance over the facilities lifetime.
- B. Reconfiguration and modifications shall comply with manufacturer's warranty requirements. Extensive or unusual changes will require additional Shop Drawings and manufactured components.

END OF SECTION

SECTION 10 26 00

WALL PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
 - 2. Protective wallcovering.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

PART 2 PRODUCTS

2.1 CORNER GUARDS

- A. Manufacturers:
 - 1. C/S Group.
 - 2. InPro Corporation.
 - 3. Koroseal Wall Protection Systems, Inc.
 - 4. Pawling Corp.
 - 5. Substitutions: Permitted.

2.2 COMPONENTS

- A. Corner Guard Surface Mounted: High impact vinyl, with 1-1/2" wing.
 - 1. Height: From top of base to ceiling.
 - 2. Color: : InPro Graystone 0151, or approved equal.
- B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.3 PROTECTIVE WALLCOVERING

- A. Manufacturer: P3TEC, or approved equal.
- B. Wallcovering:
 - 1. Thickness: 0.038".
 - 2. Width (Finished): Trims to 48 inches.
 - 3. Style/Color: Dimension, Icy Bridge P3TEC-60213
- C. Properties:
 - 1. Impact Resistance: ASTM D-5420, 24 to 100+in. lbs.
 - 2. Abrasion Resistance: ASTM D-4060, 200 cycles, 0.02% weight loss.
 - 3. Chemical Resistance: ASTM D-1308. after 7 days, no change.
 - 4. Class A
- D. Adhesive and Primer: As recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION - CORNER GUARDS

- A. Position corner guard from top of base to ceiling.
- B. Provide adhesive as recommended by manufacturer, if required, for a secure installation.

3.2 INSTALLATION - WALLCOVERING

- A. Prepare surfaces in accordance with manufacturer's instructions.
- B. Ensure walls are structurally sound, smooth, clean and dry.
- C. Repair any wall irregularities.
- D. Test for and eliminate sources of moisture accumulation into wall.
- E. Apply primer, in accordance with manufacturer's instructions.
- F. Install wallcovering in accordance with manufacturer's instructions.
- G. Install wall seams vertical, with tight fit, using overlap/double-cut technique. Do not locate seams closer than 6 inches to corners. Do not wrap outside corners.
- H. Remove paste residue.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Toilet accessories.

1.2 DESIGN REQUIREMENTS

- A. Design grab bars and attachments to resist forces as required by applicable code.

1.3 SUBMITTALS

- A. Product Data: Required.

PART 2 PRODUCTS

2.1 TOILET ACCESSORIES

- A. Manufacturers:
 - 1. A & J Washroom Accessories.
 - 2. American Specialties, Inc.
 - 3. Bobrick.
 - 4. Bradley Corp.
 - 5. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Keys: Furnish 3 keys for each accessory to Owner; master key accessories.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269, stainless steel.
- D. Mirror Glass: Float glass, with silvering, copper coating, and suitable protective organic coating.
- E. Adhesive: As recommended by manufacturer.

2.3 TOILET ROOM ACCESSORIES

- A. Refer to Schedule at end of this Section.

2.4 FACTORY FINISHING

- A. Stainless Steel: No. 4 satin brushed.
- B. Chrome/Nickel Plating: ASTM B456, satin finish.

- C. Galvanizing: ASTM A123/A123M.
- D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install plumb and level, securely and rigidly anchored to substrate.
- B. Mounting Heights and Locations: As required by accessibility regulations and as follows:
 - 1. Bottom of Mirrors: 40" to bottom of reflective surface.
 - 2. Horizontal Grab Bars: Centerline 36" AFF.
 - 3. Vertical Grab Bar: Bottom mounted at 40" AFF, centerline 40" from back wall.
 - 4. Toilet Paper Dispenser: Centerline 24" AFF, 30" from back wall.
 - 5. Paper Towel Dispenser: Bottom at 48" AFF max.

3.2 SCHEDULES

- A. Grab Bars: 1-1/2" clearance, concealed mounting, one 42" and one 36" horizontal, and one 18" vertical at each handicapped water closet.
 - 1. ASI 3800 Series
 - 2. Bobrick B-6206
 - 3. Bradley 812 Series
- B. Toilet Paper Dispensers: Double unit, one at each water closet.
 - 1. ASI 7305-2
 - 2. Bobrick B-686
 - 3. Bradley 5234
- C. Combination Paper Towel Dispenser/Waste Receptacles: Semi-recessed. Provide one at each restroom and Lactation Room.
 - 1. ASI 0467 (7 gallons): Mount bottom 40" AFF.
 - 2. Bobrick B- 3942 (12 gallons): Mount 60 1/2" to top of unit.
 - 3. Bradley 2252 (5.75gallons): Mount top 57 1/2" AFF.
- D. Soap Dispensers: N.I.C.
- E. Mirrors: Refer to Section 08 80 00 for mirrors, and refer to Drawings for wood frame surrounds.
- F. Mop and Broom Holder: Provide one at each Janitor's Room.
 - 1. ASI 1315
 - 2. Bobrick B-239 x 34
 - 3. Bradley 9984

END OF SECTION

SECTION 10 35 00

FLAGPOLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Vertical ground-set flagpoles.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate component locations, dimensions, and attachment and anchors.
- B. Product Data: Provide data on materials and accessories.

PART 2 PRODUCTS

2.1 FLAGPOLE

- A. Manufacturer: American Flagpole (1-800-368-7171), Model #94157, or approved equal.
- B. Dimensions:
 - 1. Exposed Heights:
 - a. U.S Flag: 30'-0" high
 - b. Other Flags: 25'-0"
- C. Features: Finial at top with internal halyard with winch and locking door; standard aluminum finish.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that surfaces are ready to receive work as instructed by the manufacturer.

3.2 INSTALLATION

- A. Install flagpoles in concrete settings, size and configuration as recommended by manufacturer.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire extinguishers and fire extinguisher cabinets.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. Underwriters Laboratories Inc.:
 - 1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10 code.
- B. Provide extinguishers and cabinets classified and labeled by testing firm acceptable to authority having jurisdiction for purpose specified and indicated.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and fire ratings where applicable.
- C. Product Data: Submit extinguisher operational features, color and finish, anchorage details size.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install extinguishers when ambient temperature is capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Manufacturers:
 - 1. JL Industries.
 - 2. Larsen's Manufacturing Co.
 - 3. Potter Roemer.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Type: Cast steel tank, with pressure gage.
 - 1. Quantity: 5.

2.2 FIRE EXTINGUISHER CABINETS

- A. Manufacturers:
 - 1. Larsen's
 - 2. J. L. Industries
 - 3. Substitutions: Section 01 60 00 - Product Requirements .
- B. Finish: Formed stainless steel; fire rated where shown in fire rated partitions.
- C. Configuration: Semi-recessed type, sized to accommodate extinguisher.
- D. Trim Type: Returned to wall surface, with 4-1/2 inch projection.
- E. Door: Full glass.
- F. Door Glazing: Glass, clear, 1/8 inch thick tempered.
- G. Cabinet Mounting Hardware: Appropriate to cabinet.
- H. Form cabinet enclosure with right angle inside corners and seams.
- I. Weld, fill, and grind components smooth.
- J. Quantity: 4.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install cabinets plumb and level in wall openings, 48 inches from finished floor to top of extinguisher handle.

- B. Install wall brackets, 48 inches from finished floor to top of extinguisher handle in Elevator hoistway, as required by code.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

END OF SECTION

SECTION 12 20 00

WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. Provide window shades and accessories as follows:
 - 1. Shade fabric: Fire resistant, openness factor as required by orientation and glazing; single sunscreen shadeband with specified weave.
 - 2. Operation / Manual: Offset side-mounted chain operator for manual operation as either single-band or multi-band shades.
 - 3. Mounting: Ceiling mounted to structure or brackets mounted to structure in gypsum wallboard coves; provide closure trim.
 - 4. Shade Orientation: Regular roll, shade cloth falls at window side of roller.
 - 5. Configuration: Single band per windows opening.
 - 6. Accessories without exposed fastening: Snap-on fascia.

1.2 SUBMITTALS

- A. Shop Drawings: Include typical elevation layout, shade fabrication, fasteners, installation methods and clearance for mounting condition.
- B. Samples: Submit minimum 5" x 6" fabric samples and samples of exposed metal finishes.

1.3 QUALITY ASSURANCE

- A. Provide shade system as a complete unit produced by one manufacturer, including hardware, accessory items, mounting brackets and fastening.
- B. Provide products of acceptable manufacturers with satisfactory use in similar service for three years. Use experienced installers.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle and store materials in accordance with manufacturer's instructions.

1.5 WARRANTY

- A. Five year warranty on manually operated components, except bead chain which is a maintenance / service item.
- B. Five year warranty on shade cloth with provision that it will not deteriorate, sag or warp and will remain fit for use for the full warranty period when used as an interior rollershade.
- C. Provide five year warranty for hardware components to be free from defects in material and workmanship under the normal and proper use.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturer: Mechoshade, Draper , or SWF Contract.
- B. Shade Cloth: SWF Contract, A300, F303 White/Platinum or approved, matching fabric.
- C. Manual Shade System: Pre-engineered unit with one-piece molded sprockets and a linear disc brake opposed to a flat steel backing plate and concealed variable-adjustment mechanism. Shade mechanism shall be adjustable from 100% friction (static mode) with infinite positions to 15% friction (dynamic mode) with only pre-selected positions. The operator shall be a side-mounted gear and sprocket mechanism located within the drive-end bracket. The shade cloth shall be removable with a snap-on and snap-off mounting (Snap-Loc™) spline without having to remove the shade tube.
- D. SnapLoc™ Fascia
 - 1. Extruded aluminum pocket with exposed tile support and pocket closure with baked-enamel finish.
 - 2. Accessibility by removing closure. No exposed screws or mounting means. Pocket shall be sized for single shadeband.
- E. Location: Refer to Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify mounting surface acceptability, installation conditions, and field measurements.
- B. Take field measurements prior to the fabrication to ensure fit.

3.2 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals.
- B. Install level and plumb.

END OF SECTION

SECTION 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Carpet mat and frame set flush with porcelain tile.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.
- C. Samples: Required.

PART 2 PRODUCTS

2.1 FLOOR MATS

- A. Manufacturers: This specification is based on Pedimat, by Construction Specialties. Equal or superior products may be considered for substitution.

2.2 COMPONENTS

- A. Frame: The actual frame is not recessed into the concrete. However, an aluminum angle frame is required for an installation flush with the adjacent porcelain tile.
- B. Tread Inserts: Solution dyed, 100% nylon carpet; fibers fusion bonded to rigid two-ply backing.
- C. Rails: Rigid vinyl/acrylic, with cushions
- D. Hinge Rail connectors: Clear anodized aluminum.
- E. Carpet: CS #7323 Castle Grey, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install mat frames to achieve flush plane with finished floor surface.

END OF SECTION

SECTION 12 93 13

BICYCLE RACKS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Cast-in-place, stainless steel bike racks.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data:
 - 1. Manufacturer's standard product literature.
 - 2. Shop drawings.
 - 3. Installation instructions.
 - 4. Maintenance instructions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum 15 years experience in the manufacture of site furnishings and amenities.
 - 2. Provide reference list of at least ten major transportation authorities, municipalities, universities, or other high-use public environments currently using site furnishings and amenities fabricated by the manufacturer.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Handle products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's original packaging until ready for installation.
- C. Protect products from impacts and abrasion during storage.

1.05 WARRANTY

- A. Provide manufacturer's standard warranty:
 - 1. Warranty terms: one year from date of invoice against defects in materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis-of-Design Product: provide bike racks based on the product named:
 - 1. Bike Garden Bike Rack by Forms+Surfaces.

2. Manufacturer Contact:
Forms+Surfaces
30 Pine Street
Pittsburgh, PA 15223
phone: 800-451-0410
fax: 412-781-7840
email: sales@forms-surfaces.com
website: www.forms-surfaces.com

B. Bike Racks

1. Materials:
 - a. Body: Cast stainless steel and stainless steel tubing.
 - b. Hardware: Stainless steel.
2. Finish: Stainless steel with radial Satin finish
3. Style: Refer to Drawings.
4. Mounting: Cast-in-place.
5. Configuration: Provide two 16" legs, one 20" leg, one 25" leg, one 30" leg, and one 36" leg.
Exact layout to be decided during submittal phase.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are stable and capable of supporting the weight of items covered under this section.
- B. Verify that substrates have been adequately prepared to securely anchor those items that will be surface mounted.

3.02 INSTALLATION

- A. Install according to the manufacturer's installation instructions.
- B. Install in conformance to applicable ADA guidelines and End User's established Accessibility policies.

END OF SECTION

SECTION 14 21 00

ELECTRIC TRACTION ELEVATOR

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Electric traction elevator.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-In-Place Concrete.
 - 2. Section 07 19 00 - Waterproofing.

1.02 REFERENCES

- A. Comply with applicable building and elevator codes at the project site, including but not limited to the following:
 - 1. ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
 - 2. ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
 - 3. ADAAG, American Disabilities Act Accessibility Guidelines.
 - 4. ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
 - 5. ANSI/NFPA 70, (NEC) National Electrical Code.
 - 6. ANSI/UL 10B, Standard for Fire Test of Door Assemblies.
 - 7. ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives.
 - 8. Building Codes IBC.
 - 9. All Local Jurisdictional applicable codes.

1.03 SYSTEM DESCRIPTION

- A. Equipment Description: Gen2® gearless machine-room-less elevator where all components fit inside the hoistway.
- B. Seismic Requirements: Installation must meet code requirements for category "D".
- C. All parts are to be universal.
- D. Elevator must connect to the emergency elevator.

1.04 SUBMITTALS

- A. Note: The laminate for the wall panels is specified. If a substitute manufacturer does not have an acceptable laminate, a special order will be required. Obtain approval of finishes BEFORE beginning shop drawings.
- B. Product Data:
 - 1. Signal and operating fixtures, operating panels and indicators.
 - 2. Cab design, dimensions and layout.
 - 3. Hoistway door and frame details.

4. Electrical characteristics and connection requirements.
 5. Expected heat dissipation of elevator equipment in hoistway (BTU).
- C. Shop Drawings:
1. Car, guide rails, buffers, and other components in hoistway.
 2. Maximum rail bracket spacing.
 3. Maximum loads imposed on guide rails requiring load transfer to building structure.
 4. Clearances and travel of car.
 5. Clear inside hoistway and pit dimensions.
 6. Location and sizes of access doors, hoistway entrances and frames.
- D. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.05 QUALITY ASSURANCE

- A. Manufacturer: ISO 9001 certified.
- B. Manufacturer shall have a minimum of fifteen years of experience in the fabrication, installation and service of elevators.
- C. Installer: Elevators shall be installed by the manufacturer.
- D. Permits, Inspections and Certificates: Obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. Tests to be made in the presence of such authorities or their authorized representatives.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.
- B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage and redelivery to the job site shall not be at the expense of the elevator contractor.

1.07 WARRANTY

- A. Provide manufacturer's one (1) year warranty from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.08 MAINTENANCE AND SERVICE

- A. Provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.
- B. The periodic lubrication of elevator components shall not be required, including: Sheaves, Rails, Belts, Ropes, Car and CWT guides, etc.
- C. Provide the following:
 - 1. In the controller, the necessary devices to run the elevator on inspection operation.
 - 2. On top of the car the necessary devices to run the elevator in inspection operation.
 - 3. In the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.
 - 4. In the event of a power outage, means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
 - 5. The means from the controller to reset the governor over speed switch and also trip the governor.
 - 6. The means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
- D. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
 - 1. Remotely diagnose elevator issues with a remote team of experts
 - 2. Remotely return an elevator to service
 - 3. Provide real-time status updates via email
 - 4. Remotely make changes to selected elevator functions including:
 - a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode and activate independent service.
 - b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
 - c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer: Design based upon Otis Elevator's Gen2™ machine room-less elevator system. Equal or superior products by the following manufacturers will be considered for substitution in accordance with Section 01 60 00.
 - 1. Thyssen Krupp
 - 2. Kone
 - 3. Schindler

2.02 PRODUCTS

- A. Elevator: Machine-roomless Gen2™ traction passenger elevators.
1. Controller located entirely inside the hoistway.
 2. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.
 3. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
 4. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
 5. LED lighting standard in ceiling lights and elevator fixtures.
 6. Sleep mode operation for LED ceiling lights and car fan.
- B. Components:
1. Drive: Regenerative.
 2. Stops: 2.
 3. Openings: In-Line.
 4. Travel: 16 ft .
 5. Rated Capacity: 3000 lbs. (1361 kg)
 6. Rated Speed: 200 fpm (0.76 mps).
 7. Hoistway Size: 8'-6" W x 6'-4" D.
 8. Clear Inside Dimensions: 6'-5 9/16" W x 5'-0 3/16" D.
 9. Cab Height: 7'-9" (2362 mm).
 10. Clear Cab Height: 7'-9" (2362 mm) .
 11. Entrance Type and Width: Center-Opening Doors- 42" (1067 mm).
 12. Entrance Height: 7'-0" (2134 mm).
 13. Main Power Supply: 480 volts, 5% of normal, three-phase, with a separate equipment grounding conductor.
 14. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.
 15. Machine Location: Inside and at the top of the hoistway.
 16. Signal Fixtures: Manufacturer's standard with metal button targets.
 17. Controller Location: Machine-Roomless- controller(s) must be in the front wall on the same side as the counterweight, located at the top landing.
 18. Performance:
 - a. Car Speed: 3 % of contract speed under any loading condition or direction of travel.
 - b. Car Capacity: Safely lower, stop and hold up to 120% of rated load (code required).
 19. Ride Quality:
 - a. Vertical Vibration (maximum): 20 milli-g.
 - b. Horizontal Vibration (maximum): 12 milli-g.
 - c. Vertical Jerk (maximum): 4.59 1.0 ft./ sec³.
 - d. Acceleration/Deceleration (maximum): 2.62 ft./ sec².
 - e. In Car Noise: 55 – 60 dB(A).
 - f. Stopping Accuracy: 0.375 in. max, 0.25 in. typical.
 - g. Re-leveling Distance: 0.5 in.
- C. Operation: **Simplex Collective**; using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

D. Operation Features:

1. Full Collective Operation.
2. Anti-nuisance.
3. Fan and Light Protection.
4. Load Weighing Bypass.
5. Independent Service.
6. Firefighters' Service Phase I and Phase II.
7. Top of Car Inspection.
8. Zoned Access at Bottom Landing.
9. Zoned Access at Upper Landing.
10. Car Secure Access.
11. Automatic Rescue Operation.

E. Door Control Features:

1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
3. Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.
4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

2.03 EQUIPMENT: CONTROLLER COMPONENTS

A. Controller: Provide a microcomputer based control system to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.

1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"
5. Controller to be located inside the wall next to the top landing entrance frame. Emergency access shall be provided through an access panel in the entrance frame secured by a key lock.
6. Drive: Provide a Variable Voltage Variable Frequency AC drive system. The drive is to be set up for regeneration of AC power back to the building grid.

2.04 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: Tension type car-mounted governor.

- C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute. Oil buffers shall be used for a speed of 350 feet per minute.
- D. Hoistway Operating Devices:
 - 1. Emergency stop switch in the pit.
 - 2. Terminal stopping switches.
- E. Positioning System: Consists of an encoder, reader box, and door zone vanes.
- F. Guide Rails and Attachments: Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.
- G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.
- H. Governor Rope: Steel, consisting of at least eight strands wound about a sisal core center.
- I. Fascia: Provide galvanized sheet steel at the front of the hoistway.
- J. Hoistway Entrances:
 - 1. Frames: Bolted construction for complete one-piece unit assembly. Fasten all frames to fixing angles mounted in the hoistway and be of UL fire rated steel.
 - 2. Extruded Aluminum Sills at: 1, 2, 3
 - 3. Doors: Metal construction with vertical channel reinforcements.
 - 4. Fire Rating: UL fire rated for 1-1/2 hour
 - 5. Frame and Entrance Finishes: Brushed Stainless Steel Frames and Entrances
 - 6. Entrance Marking Plates: 4" x 4" (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Provide marking plates on both sides of the entrance.
 - 7. Sight Guards: Furnished with all doors painted black.

2.05 EQUIPMENT: CAR COMPONENTS

- A. Car Frame and Safety: Provide car frame fabricated from formed or structural steel members with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp type.
- B. Cab: Premium, Steel Shell Cab with raised laminate wall panels.
 - 1. Laminate: Neutral Twill or approved equal. If an acceptable laminate is not available, a special order may be required, at no additional cost to the Owner.
 - 2. Brushed Stainless Steel finished base plate located at top and bottom.
 - 3. Brushed Stainless Steel finished vertical trim pieces are optional.
- C. Car Front Finish: Satin stainless steel.

- D. Car Door Finish: Satin stainless steel.
- E. Floor: Porcelain tile provided and installed by others.
- F. Ceiling Type: Flat ceiling with 4 LED Lights.
- G. Ceiling Finish: Brushed steel finish.
- H. Fan: Two-speed 120 VAC fan with a baffle to diffuse audible noise, rubber mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. Provide a switch in the car-operating panel to control the fan.
- I. Handrail: Round bars with brushed steel finished handrails on the side and rear walls
- J. Threshold: Extruded Aluminum.
- K. Emergency Exit Contact: Provide an electrical contact on the car-top exit.
- L. Guides: Provide 3" diameter roller guides at top and bottom and slide type guides at the top and bottom of the counterweight.
- M. Platform: Constructed of metal. Mount load weighing device on the belts at the top of the hoistway.
- N. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.
- O. Certificate Frame: Satin stainless steel finish.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

- A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.
 - 1. Buttons: Bank of round stainless steel, mechanical LED illuminated buttons, flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings. The buttons to be Lexan 1/8" (3mm) projecting buttons, fully illuminated by a white LED.
 - 2. Car Operating Panel Features:
 - a. Raised markings and Braille to the left hand side of each push-button.
 - b. Car Position Indicator at the top of and integral to the car operating panel.
 - c. Door open and door close buttons.
 - d. Inspection key-switch.
 - e. Elevator Data Plate marked with elevator capacity and car number.
 - f. Help Button: Initiates two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
 - g. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator. Car Position Indicator is at the top of and integral to the car operating panel.

- h. In car stop switch (toggle or key unless local code prohibits use)
 - i. Firefighter's hat
 - j. Firefighter's Phase II Key-switch
 - k. Call Cancel Button
- B. Car Position Indicator: A digital, LED car position indicator, integral to the car operating panel.
- C. Hall Fixtures and Key Switches: Brushed stainless steel finish.
 - 1. Round stainless steel, mechanical buttons marked to correspond to the landings. Locate hall fixtures in the entrance frame face or the wall. Buttons to be in vertically mounted fixture.
 - 2. Hall Buttons: Flat Flush Mounted satin stainless steel button with blue or white LED illuminating halo.
- D. Car Lantern and Chime: Directional lantern visible from the corridor in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- E. Hall Position Indicators: At Levels 1 and 2.
- F. Provide access key-switch at both floors in entrance jambs.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install all elevator components, except as specifically provided for elsewhere by others.

3.03 DEMONSTRATION

- A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

END OF SECTION

SPECIFICATIONS:

DIVISION 22 and 23

PROJECT:

First Community Bank – Jonesboro, AR

DATE:

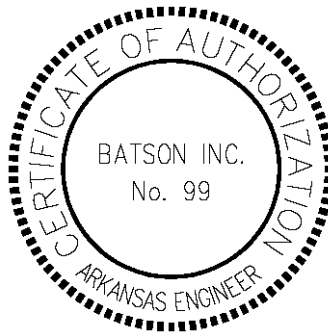
December 7, 2022

BATSON INC. PROJECT NO.:

5794



Milton Canizares, P.E.



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First Community Bank
Greensboro Village
Jonesboro, AR

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SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

2.02 SLEEVE-SEAL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above and below Grade and Interior Floors, Partitions, Roofs, and Walls:

- a. Piping NPS 10 and smaller: Cast-iron wall sleeves.

END OF SECTION 22 05 17

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze gate valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.02 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 1. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

2.03 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.

- g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

2.04 IRON GATE VALVES

- A. Class 125, NRS, Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC
 - j. Powell Valves.
 - k. Red-White Valve corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-70, Type I
 - b. CWP Rating: 200 psig (1380kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or gate valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: solder-joint valve.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Threaded valve-end option.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 - 1. Bronze Valves: provided with solder-joint ends.
 - 2. Ball Valves: Two piece, full port, bronze with bronze trim.
 - 3. Bronze Gate Valves: Class 125, NRS.
- B. Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100)
 - 1. Iron Valves: Provide with threaded or flanged ends.
 - 2. Iron Gate Valves: Class 125, NPS

END OF SECTION 22 05 23

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.

- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping (Cold Water / Hot Water / Hot Water Return):
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Gas piping (Natural Gas and Propane):
 - a. Background Color: Yellow.
 - b. Letter Color Black.
 - 3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Blue
 - b. Letter Color: White

END OF SECTION 22 05 53

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold, hot-water and hot-water recirculation piping.
 - 2. Supplies and drains for handicap-accessible lavatories and sinks.
 - 3. Sanitary waste piping exposed to freezing conditions.
 - 4. Storm-water piping exposed to freezing conditions and horizontal piping within building.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Glass-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F (454 Deg C) Materials: glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Glass-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
- 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.05 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.08 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with closed seal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches (50 mm)] [4 inches (100 mm)] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF GLASS-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.06 FINISHES

- #### A.
- Do not field paint aluminum or stainless-steel jackets.

3.07 PIPING INSULATION SCHEDULE, GENERAL

- #### A.
- Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.08 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot Water and Hot Water Return: Insulation shall be the following:

1. Glass-Fiber, Preformed Pipe Insulation, Type I: $\frac{1}{2}$ " thickness for runouts, 1" thick for pipe sizes up to 2", and 1-1/2" thick for pipe sizes greater than 2".

B. Internal Storm Drain (Horizontal Above-Grade). Insulation shall be the following:

1. Owens-Corning 1" thick Fiberglas, one piece, pipe insulation with factory-applied White All-Service (ASJ) Vapor Barrier Jacket. Fittings shall be molded or mitered Fiberglas. Insulate bottom of drain pot exposed, insulate elbow at connection to drain in horizontal run including the elbow to vertical.

END OF SECTION 22 07 19

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.

1.02 SUBMITTALS

- ###### A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

- ###### A. Piping materials shall bear label, stamp, or other marking of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- ###### A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS

- ###### A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

- ###### B. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. NIBCO Inc.
 - b. Viega.
2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.03 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Pipe-Flange Gasket Materials:
 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 2. Full-face or ring type unless otherwise indicated.

2.04 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2.05 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- D. Sleeve-Type Transition Coupling: AWWA C219.

2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 1. Description:
 - a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- E. Dielectric Flanges:
 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- F. Dielectric Nipples:

1. Description:
 - a. Electroplated steel nipple.
 - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.07 FLEXIBLE CONNECTORS

- G. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
 2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
- H. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
 2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install domestic water piping level and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping adjacent to equipment and specialties to allow service and maintenance.
- I. Install piping to permit valve servicing.

- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

3.03 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
 - 2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

3.06 FLEXIBLE CONNECTOR INSTALLATION

- A. Install bronze-hose flexible connectors in copper domestic water tubing.
- B. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.07 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 Feet (3m) with 1/2-inch (13-mm) rod.

- E. Install supports for vertical copper tubing every 10 feet (3 m).
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.08 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.09 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

- b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.

- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground domestic water piping, NPS 4 (DN 100) and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) wrought- copper solder-joint fittings; and soldered joints or copper pressure-seal-joint fittings; and pressure-sealed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 (DN 100), shall be the following:
 - 1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings.
- E. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 3 (DN 65) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 4 (DN 100).
 - 2. Drain Duty: Hose-end drain valves.

END OF SECTION 22 11 16

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

C. Pipe and Fittings: ASTM A 888 or CISPI 301.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.

- f. Stant.
 - g. Tyler Pipe.
2. Standards: ASTM C 1277 and ASTM C 1540.

2.04 SPECIALTY PIPE FITTINGS

E. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.03 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.04 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.
 - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, and coupling.
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 (DN 150): 60 inches (1500mm) with 3/4-inch (19-mm) rod.
 - 5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 6 and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping NPS 8 and smaller shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- E. Aboveground grease waste piping NPS4 and smaller to be the following:
1. Hubless, cast-iron soil pipe and fitting; heavy-duty hubless-piping couplings; and coupled joints.
- F. Underground grease waste piping NPS4 and smaller to be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 22 13 16

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Roof flashing assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.
 - 7. Grease interceptors.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.14.1.
 - 3. Size: Same as connected piping.
 - 4. Body: Cast iron.

5. Cover: Cast iron with [bolted] access check valve.
6. End Connections: [Hub and spigot].
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang [closed].
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.02 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.

- e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for adjustable housing, cast-iron soil pipe with cast-iron ferrule cleanout.
 3. Size: Same as connected branch.
 4. Body or Ferrule: Cast iron.
 5. Clamping Device: Required.
 6. Outlet Connection: Inside calk.
 7. Closure: Brass plug with straight threads and gasket.
 8. Adjustable Housing Material: Cast iron with threads or set-screws or other device.
 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 10. Frame and Cover Shape: Round.
 11. Top Loading Classification: Heavy Duty.
 12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M. Include wall access.
 3. Size: Same as connected drainage piping.
 4. Body: Hubless, cast-iron soil pipe test tee] as required to match connected piping.
 5. Closure: Countersunk, brass plug.
 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
 8. Wall Access: Round nickel-bronze or stainless-steel wall-installation frame and cover.

2.03 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.6.3.
 3. Pattern: Floor drain.

4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Top Loading Classification: Heavy Duty.
16. Funnel: Not required.
17. Inlet Fitting: Not required.
18. Trap Material: Cast iron.
19. Trap Pattern: Deep-seal P-trap.
20. Trap Features: Cleanout

2.04 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of [4.0-lb/sq. ft., 0.0625-inch-] thick, lead flashing collar and skirt extending at least [8 inches] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping or with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch] above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.06 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Assemble open drain fittings and install with top of hub 1 inch above floor.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install vent caps on each vent pipe passing through roof.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:

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. ANACO-Husky.
 - b. MIFAB, Inc.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.04 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564
 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources using Small-Scale Environmental Chambers".

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 1 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 Storm-Drainage Piping: 1 percent downward in direction of flow.
- J. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- K. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
 - 2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- P. Install underground PVC piping according to ASTM D 2321.

3.02 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Plastic, Nonpressure-Piping, Solvent-Cemented 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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.
 - 3. Up to and including first elbow: Service class, cast-iron soil-pipe and fittings; gaskets; and gasketed joints.
 - 4. Downstream of first elbow: Solid-wall PVC pipe, PVC socket fittings, and solvent cemented joints.

3.03 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Individual, Straight, Horizontal Piping Runs:
 - 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.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 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 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install supports for vertical copper tubing every 10 feet.

- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect storm drainage piping to roof drains and storm drainage specialties.
 - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
 - 2. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.05 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.06 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.
 - 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 storm drainage 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure: Test storm drainage piping, 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 until completion of inspection, water level must not drop. Inspect joints for leaks.

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.

3.07 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.

3.08 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 10 and smaller shall be any of the following:
 1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
- C. Underground storm drainage piping NPS 16 and smaller shall be the following.
 1. Up to and including first elbow: Service class, cast-iron soil-pipe and fittings; gaskets; and gasketed joints.
 2. Downstream of first elbow: Solid-wall PVC pipe, PVC socket fittings, and solvent cemented joints.

END OF SECTION 22 14 13

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Roof drains.
 - 2. Miscellaneous storm drainage piping specialties.
 - 3. Flashing materials.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 METAL ROOF DRAINS

- A. Refer to schedule on the drawings.

2.02 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Conductor Nozzles:
 - 1. Refer to schedule on the drawings.

2.03 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft..
- B. 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.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.

- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install expansion joints, if indicated, in roof drain outlets.
 - 3. Position roof drains for easy access and maintenance.
- B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate cleanouts at base of each vertical soil and waste stack.
- D. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 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 the pipe size, with a minimum length of 10 inches and with 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Metraflex Company (The).
 - 3. Pipeline Seal and Insulator, Inc.
 - 4. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves or Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves or Galvanized-steel-pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.

- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 05 18

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Bronze gate valves.
6. Iron gate valves.
7. Bronze globe valves.
8. Iron globe valves.
9. Chainwheels.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Legend Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

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. Cooper Cameron Valves; a division of Cooper Cameron Corp.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Legend Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Norriseal; a Dover Corporation company.
 - i. Spence Strainers International; a division of CIRCOR International.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

2.04 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.05 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Legend Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

2.06 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded[or solder joint].
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.

- h. Handwheel: Malleable iron.

2.07 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Legend Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Disc: Solid wedge.
 - h. Packing and Gasket: Asbestos free.

2.08 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded[or solder joint].
 - e. Stem and Disc: Bronze.

- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron.

2.09 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

2.10 CHAINWHEELS

- ### 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. Babbitt Steam Specialty Co.
 2. Roto Hammer Industries.
 3. Trumbull Industries.
- ### B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 2. Attachment: For connection to butterfly valve stems.
 3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.[Include zinc coating.]
 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. 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.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. 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.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.03 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Throttling Service, Except Steam: Globe, ball, or butterfly valves.
 - 3. Throttling Service, Steam: Globe valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

- b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.05 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: Provided with solder-joint ends.
 - 2. Ball Valves: Two piece, full port, with bronze trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
 - 4. Bronze Gate Valves: Class 125, RS, bronze.
 - 5. Bronze Globe Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, (EPDM) seat, aluminum-bronze disc.
 - 3. Iron Swing Check Valves: Class 125 metal seats.
 - 4. Iron Gate Valves: Class 125 OS&Y.
 - 5. Iron Globe Valves: Class 125.

3.06 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: Provided with solder-joint ends.
 - 2. Ball Valves: Two piece, full port, with bronze trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.
 - 4. Bronze Gate Valves: Class 125, RS.
 - 5. Bronze Globe Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125 OS&Y.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

END OF SECTION 23 0 5 23

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.05 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to [1-1/2 inches].

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 3. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 4. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 23 05 29

IDENTIFICATION FOR HVAC PIPING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.

1.02 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel [rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Refrigerant Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 - 2. Condensate Drain Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 - 3. Chilled-Water Piping (Supply and Return)
 - a. Background Color: Green
 - b. Letter Color: White
 - 4. Heating Hot-Water Piping (Supply and Return):
 - a. Background Color: Yellow
 - b. Letter Color: Black

END OF SECTION 23 05 53

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TAB Specialist: An entity engaged to perform TAB Work.

1.03 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

1.04 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the

indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

3.07 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
 1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.09 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.10 REPORTING

A. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.

5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Terminal units.
 5. Balancing stations.
 6. Position of balancing devices.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Outdoor, concealed supply and return.
 - 4. Outdoor, exposed supply and return.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.02 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.04 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg. F.
 4. Color: Aluminum.
 5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. Finish and thickness are indicated in field-applied jacket schedules.
 2. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick polysurlyn.

2.07 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Width: 3 inches.
 2. Thickness: 6.5 mils
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with closed seal.
- B. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, [galvanized-steel] [aluminum] [stainless-steel] sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.07 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return air.
- B. Items Not Insulated:
 - 1. Factory-insulated flexible ducts.
 - 2. Factory-insulated plenums and casings.
 - 3. Flexible connectors.
 - 4. Vibration-control devices.
 - 5. Factory-insulated access panels and doors.
 - 6. Exhaust Ducts.

3.08 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Round, Flat-Oval and Rectangular Supply-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Round, Flat-Oval and Rectangular Return-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, Round, Flat-Oval and Rectangular Outdoor-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.

3.09 ABOVE GROUND, OUTDOOR DUCT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, rectangular, return-air and supply-air duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed, up to 48 inches (1200 mm) in diameter or with flat surfaces up to 72 inches (800 mm):
 - 1. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

END OF SECTION 23 07 13

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Heat exchangers.
2. Heating, hot-water pumps.
3. Expansion/compression tanks.
4. Air separators.
5. Buffer Tanks.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230719 "HVAC Piping Insulation."

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail removable insulation at equipment connections.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 2. Block Insulation: ASTM C 552, Type I.
 3. Special-Shaped Insulation: ASTM C 552, Type III.
 4. Board Insulation: ASTM C 552, Type IV.
 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- F. Flexible Elastomeric 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. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet and K-FLEX LS.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Knauf Insulation; Friendly Feel Duct Wrap.
 - c. Owens Corning; SOFTR All-Service Duct Wrap.

- H. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Industrial Insulation Group (IIG); MinWool-1200 Flexible Batt.
 - b. Johns Manville; HTB 26 Spin-Glas.
 - c. Roxul Inc.; Roxul RW.
- I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; CertaPro Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Owens Corning; Fiberglas 700 Series.
- J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; FBX.
 - b. Industrial Insulation Group (IIG); MinWool-1200 Industrial Board.
 - c. Rock Wool; Delta Board.
- K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.05 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Pittsburgh Corning Corporation; Pittseal 444.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 4. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Sheet and roll stock ready for shop or field sizing..
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- D. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with [white] aluminum-foil facing.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard Products, Inc.; Alumaguard 60.

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.

- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.

- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
 - 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

- c. Spindle: [Copper- or zinc-coated, low-carbon steel], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, [galvanized-steel] sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - 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) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: [0.080-inch nickel-copper alloy].
 - 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. C & F Wire.

2.11 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
 1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.03 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.

- g. 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. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 - 7. Stagger joints between insulation layers at least 3 inches.
 - 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 - 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 - 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
- 1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
- 1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 - 2. Fabricate boxes from galvanized steel, at least 0.040 thick.
 - 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.04 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
- 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket 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-barrier mastic.

- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.05 FINISHES

- A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to [one] location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.07 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Insulate exterior of VAV box electric re-heat section according to duct insulation schedule.

3.08 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth 0.024 inch thick.
- D. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth with 1-1/4-Inch- Deep Corrugations: 0.040 inch thick.

END OF SECTION 23 07 16

HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Chilled-water piping, indoors and outdoors.
2. Heating hot-water piping, indoors and outdoors.
3. Refrigerant suction and hot-gas piping, indoors and outdoors.
4. Condensate drain piping, indoors and outdoors.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230716 "HVAC Equipment Insulation."

1.02 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- E. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 3. Solids Content: 60 percent by volume and 66 percent by weight.
 4. Color: White.

2.05 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.07 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Finish and thickness are indicated in field-applied jacket schedules.

2. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Width: 3 inches (75 mm).
 2. Thickness: 11.5 mils (0.29 mm).
 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.09 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) [4 inches (100 mm)] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water, above 40 Deg F (5 Deg C): Insulation shall be the following:
 1. Mineral-Fiber, Preformed Pipe, Type I 1-1/2 inches (38 mm) thick.
- B. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and Below: Insulation shall be the following:
 1. Mineral-Fiber, Preformed Pipe, Type I: 1 1/2 inches (38 mm) thick.
- C. Refrigerant Suction and Hot-Gas Piping Insulation shall be the following:
 1. Flexible elastomeric 1 inch (25 mm) thick.
- D. Condensate Drain Piping:
 1. Mineral-Fiber, preformed pipe, type 1 1/2 inch (12mm) thick..

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water: Insulation shall be the following:
 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (75 mm) thick.
- B. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and Below: Insulation shall be the following:
 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
- C. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
 1. Flexible Elastomeric: 2 inches (50 mm) thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Exposed:
 - 1. Aluminum, Smooth 0.020 inch (0.51 mm) thick.

END OF SECTION 23 07 19

BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building Automation System (BAS), utilizing direct digital controls.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Products Supplied But Not Installed Under This Section (where required by project specific plans):
 - 1. Control valves.
 - 2. Flow switches and flow meters.
 - 3. Wells, sockets and other inline hardware for water sensors (temperature, pressure, flow).
 - 4. Airflow measuring stations.
 - 5. Variable frequency drives. (This does not include VFDs integral to equipment such as chillers or packaged DX units).
- B. Products Installed But Not Supplied Under This Section:
 - 1. None.
- C. Products Not Furnished or Installed But Integrated with the Work of This Section (where required by project specific plans):
 - 1. Fire alarm relays for system shutdown
 - 2. Smoke detectors (through alarm relay contacts).
 - 3. Terminal unit 24V transformers
 - 4. VAV terminal unit control enclosures
- D. Work Required Under Other Divisions Related to This Section (where required by project specific plans):
 - 1. Installation of VFD's.
 - 2. Installation of thermostat/zone sensor conduits between sensor zone location and the sensor's associated HVAC unit.
 - 3. Power wiring to line side of motor starters, disconnects or variable frequency drives.
 - 4. Power wiring to all controller enclosures.
 - 5. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
 - 6. Campus LAN (Ethernet) connection adjacent to JACE network management controller.

1.3 SYSTEM DESCRIPTION

- A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over the BACnet protocol.
 - 1. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum,

- LonTalk, BACnet and MODBUS.
2. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
 3. The BAS server or SNC shall host all graphic files for the control system.
 4. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BAS.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Submit documentation of contractor qualifications, including those indicated in "Quality Assurance" if requested by the A-E.
- D. Submit in electronic format. Submittals shall be representative of the entire control system and shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets. Provide BACnet Protocol Implementation Conformance (PICS) documentation for all DDC controllers upon Engineer request.
- E. Shop drawings shall contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.
- F. Upon completion of the work, provide electronic 'as-built' drawings and other project-specific documentation.
- G. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

1.5 QUALITY ASSURANCE

- A. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. This office shall be staffed with applications engineers, software engineers and field technicians. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this work, as well as staff trained in the use of this equipment.
- B. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building automation systems similar in size and complexity to the system specified.
- C. Equipment and Materials: Equipment and materials shall be cataloged products of

manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Trane Tracer Controls
- B. KMC Controls
- C. JCI Facility Explorer
- D. Engineer Approved Equal

2.2 GENERAL

- A. The Building Automation System (BAS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming and other control devices for a complete system as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall BAS.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing Open protocols in one open, interoperable system.
- B. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- C. The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the Operating System Server located in the facility on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.

2.4 BAS SUPERVISOR SERVER HARDWARE

- A. The BAS shall include a Supervisory Server device as required to meet the design intention for BAS performance including proper alarm management, trending performance and long term storage, backup data base storage, reasonable system performance speeds, etc. If a BAS Supervisor is not provided, the Control System Contractor shall provide sufficient performance documentation to the Engineer of Record for review and approval before

acceptance. This performance documentation must prove that the provided System Network Controller (SNC) utilized in lieu of the Supervisor Server meets the Minimum Computer Hardware Configuration requirements specified herein.

- B. Minimum Computer Hardware Configuration
 1. Processor: Intel Celeron 2.2 GHz CPU (or better)
 2. Memory: 8 GB DDR3 RAM
 3. Operating System: Windows 10 IoT version (must be able to disable automatic updates)
 4. Hard Drive: 32 GB Solid State Storage minimum, more recommended depending on archiving requirements. Minimum of 1 year of data storage.
 5. Network Support: Dual Gb LAN ports
 6. Connectivity: Full-time high-speed ISP connection shall be provided by the owner. Controls System Contractor shall offer remote connectivity via cellular service at an additional cost to the owner.
- C. Standard Client: The thin-client Web Browser BAS graphical user interface shall be Google Chrome or browser equivalent. No special software shall be required to be installed on the PCs used to access the BAS via a web browser.

2.5 SYSTEM NETWORK CONTROLLER (SNC)

- A. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC), and integrated BACnet devices which are connected to its communications trunks. The SNC shall directly communicate with the BAS Supervisor Server for sites utilizing a Supervisory Server. The SNC is also responsible to perform control and operating strategies for the system based on information from any controller connected to the BAS. The basis of design SNC shall be the Niagara JACE 8000 controller.
- B. The controllers shall be capable of peer-to-peer communications with other SNC's and with any Operator Workstation (OWS) connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.
- C. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 Fox, BACnet TCP/IP and SNMP.
- D. The SNC shall be capable of routing all BACnet ms/tp communications traffic. However, BACnet routers shall be installed to manage the ms/tp communications traffic. This requirement is enforced in order to minimize the workload of the SNC to ensure proper performance of the BAS.
- E. The SNC shall employ a device count capacity license model that supports expansion capabilities.
- F. The SNC shall be capable of executing application control programs to provide:
 1. Calendar functions.
 2. Scheduling.
 3. Trending.
 4. Alarm monitoring and routing.
 5. Time synchronization.
 6. Integration BACnet controller data.
 7. Integration of LonWorks and MODBUS controller data via the use of additional

- drivers when required.
8. Network management functions for all SNC, PEC and ASC based devices.
- G. The SNC shall provide the following hardware features as a minimum:
1. Two 10/100 Mbps Ethernet ports.
 2. Two Isolated RS-485 ports with biasing switches.
 3. 1 GB RAM
 4. 4 GB Flash Total Storage / 2 GB User Storage
 5. Wi-Fi (Client or WAP)
 6. USB Flash Drive
 7. High Speed Field Bus Expansion
 8. Integrated 24 VAC/DC Global Power Supply
 9. MicroSD Memory Card Employing Encrypted Safe Boot Technology
- H. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- I. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.
- J. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - a. Alarm.
 - b. Return to normal.
 - c. To default.
 2. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text.
 - b. Email of complete alarm message to multiple recipients.
 - c. Graphics with flashing alarm object(s).
- K. Programming software and all controller "Setup Wizards" shall be embedded into the SNC.
- L. The SNC shall support the following security functions.
1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
 2. Role-Based Access Control (RBAC) for managing user roles and permissions.
 3. Require users to use strong credentials.
 4. Data in Motion and Sensitive Data at Rest be encrypted.
 5. LDAP and Kerberos integration of access management.
- M. The SNC shall be provided with a minimum 1 Year Software Maintenance license for system upgrades during the warranty period. Additional Software Maintenance licenses shall be provided as needed to include system upgrades throughout the entire first year of system use. Labor to implement not included.

2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

- A. General: Controllers shall be responsible for monitoring and controlling directly connected HVAC equipment such as Chilled Water Systems, Cooling Towers, Hot Water Systems, Pump Systems, Geothermal Loop Systems, Domestic Water Systems, AHU's, RTU's, Split Systems, Heat Pumps, VAV Terminals, Fan Coil Units, Chilled Beams, Unit Ventilators,

Exhaust Fans, Lighting Systems, and/or other building mechanical systems as required. Each controller shall be classified as a “native” BACnet device, supporting the BACnet Advanced Application Controllers (B-AAC) profile. Controllers that support a lesser profile such as B-ASC are not acceptable without written permission from the Engineer of Record. Controllers shall conform to the BACnet Advanced Application Controller (B-AAC) profile.

B. Software Specifications

1. General: The controller shall contain non-volatile memory to store both the resident operating system and application programming. Any program may affect the operation of any other program. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, extraction of the program for storage, routing communications, etc.
2. Automatic Restart after Power Failure: Upon restoration of power after an outage, the controller shall automatically and without human intervention update all monitored functions; resume operation based on current synchronized time and status, and implement special start-up strategies as required.
3. User Programming Language: The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and set points. Controllers shall be capable of utilizing both line code based programming and Graphical Function Block programming interfaces.
 - a. Programs shall be generated by an English-language based (line) editor or a Graphical Function Block interface.
 - b. The language shall be structured to allow for the easy configuration of control programs and mathematical calculations.
 - c. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.
 - d. Controllers that use non-editable factory programming only methods will not be accepted without written permission from the Engineer of Record.
4. Control Algorithms: The controller shall have the ability to perform the following control algorithms:
 - a. Proportional, Integral plus Derivative Control (PID)
 - b. Two Position Control
 - c. Digital Filter
 - d. Ratio Calculator
 - e. Equipment Cycling Protection
5. Mathematical Functions: Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, trigonometric functions, Boolean logic statements, or combinations of all. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators.
6. Energy Management Applications: The controller shall have the ability to perform any or all of the following energy management routines where required by the sequence of operations or controls design:
 - a. Time of Day Scheduling
 - b. Calendar Based Scheduling
 - c. Holiday Scheduling
 - d. Exception Scheduling

- e. Temporary Schedule Overrides
 - f. Optimal Start
 - g. Optimal Stop
 - h. Night Setback Control
 - i. Enthalpy Switchover (Economizer)
 - j. Peak Demand Limiting, Load Shed
 - k. Temperature Compensated Duty Cycling
 - l. CFM Tracking
 - m. Heating/Cooling Interlock
 - n. Hot/Cold Deck Reset
 - o. Free Cooling
 - p. Hot Water Reset
 - q. Chilled Water Reset
 - r. Condenser Water Reset
 - s. Chiller Sequencing
 - t. Demand Ventilation
- C. History Logging: Each controller shall be capable of locally logging any input, output, calculated value, etc. over user defined time intervals (1 second minimum time). Up to 128 values shall be stored in each log. Logged data shall be downloadable to the Supervisory Server or SNC for long term archiving based upon user-defined time intervals, COV notification or manual command.
- D. Alarm Management: For each system point, alarms can be created based on high/low limits or conditional expressions. Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided. If communication with the Operator Workstation is temporarily interrupted, the alarm will be time-stamped and buffered in the controller. When communications return, the alarm will be transmitted to the Supervisory Server or SNC.
- E. Communications: The controllers shall be a native BACnet communications, available as EIA-485 (MS/TP) or Ethernet/IP physical connections as required. The controllers shall meet or exceed the specifications in the ANSI/ASHRAE BACnet Standard 135-2010 for BACnet Advanced Application.
- 1. MS/TP Devices: For devices with MS/TP connectivity, baud rates between 9600 and 115.2k baud shall be selectable. Segmentation shall be supported. Auto-baud functionality shall be supported.
 - 2. Ethernet/IP Devices: For devices enabled with Ethernet/IP connectivity, the user shall be able to select BACnet 8802-3, BACnet IP, or BACnet Foreign Device. Segmentation shall be supported.
- F. Configuration: The controller shall be configurable via the following methodologies:
- 1. Software
 - 2. Digital Sensor
 - 3. Mobile Device
- G. Programmability: The controller shall be fully programmable via a dedicated configuration software tool and/or modules integrated into the BAS Framework. Niagara is the basis of design BAS Framework. The Niagara configuration toolset shall be integral to Workbench software and not function outside of the Workbench environment. The Niagara toolset shall be able to fully program the controllers, including the ability to select, configure, and deploy standard HVAC equipment applications.

- H. Firmware Upgrades: The controller firmware shall be upgradeable for updates as future enhancements and expanded functionality. Firmware updates shall be supported via BACnet communications (over-the-network).
- I. Objects Counts: The object count shall be dynamic. The controller shall have a minimum of the following BACnet objects:
 - 1. Shall support up to 120 Analog Value Objects.
 - 2. Shall support up to 80 Binary Value Objects.
 - 3. Shall support up to 40 Multi-state Value Objects.
 - 4. Shall support up to 10 Event Enrollment Objects.
 - 5. Shall support up to 5 Notification Class Objects.
 - 6. Shall support up to 10 Loop Objects (PID).
 - 7. Shall support up to 10 Program Objects.
 - 8. Shall support up to 2 Schedule Objects.
 - 9. Shall support up to 1 Calendar Objects.
 - 10. Shall support up to 10 Trend Objects.
- J. Hardware Platform Features:
 - 1. Processor: The controller shall employ at minimum a 32-bit microprocessor.
 - 2. Memory: The operating system and the application programs for the controller shall be stored in non-volatile FLASH memory. The controller shall support up to 8 MB Flash memory and up to 2 MB of RAM. The controller shall include an on-board capacitor to back up the controller's RAM memory for a period of at least six hours. In the case of a power failure, the controller shall first try to restart from the RAM memory. If that memory is corrupted or unusable, then the controller shall restart itself from its application program stored in its FLASH memory.
 - 3. Network Communication Ports: The controller shall have on-board, dual 10/100bT Ethernet port or an EIA-485 port. The dual Ethernet connections shall function as an Ethernet hub, allowing daisy-chained Ethernet topologies. The EIA-485 port shall have network protection bulbs and integrated end-of-line (EOL) terminations.
 - 4. Inputs: The controller shall have on-board universal inputs with a minimum of 16-bit analog to digital conversion. Each universal input shall have over-voltage protection. Universal inputs shall have the following integrated, software selectable terminations: 1K pullup, 10K pullup, 0-12VDC, 0-20mA. Each universal input shall be software selectable as analog or binary. Manually set, hardware configuration jumpers shall not be necessary.
 - 5. Outputs: The controller shall have on-board universal outputs with a 12-bit digital to analog conversion. Analog outputs shall be capable of sourcing 100 mA per channel and be short circuit protected. Each universal outputs shall be software selectable as analog or binary.
 - 6. Local Status Indicator Lamps: Provide as a minimum, LED indication of CPU status, Ethernet LAN status, MS/TP LAN Status, and Expansion I/O field bus status. For each optional manual override device, provide an LED that gives a visual indication of what state it is in (ON/OFF) and markings to indicate the switch setting (H-O-A).
 - 7. Real Time Clock (RTC): Each controller shall have an integrated real-time clock, accurate to 1.5 minutes per month. Optionally, to maintain through an intermittent power failure, the RTC may be capacitor backed, maintaining time for at least 72 hours. The RTC shall provide the following: time of day, day, month, year, and day of week. The system shall automatically correct for daylight savings time and leap years.
 - 8. Terminal Block Connectors: The controller shall have removable screw terminal blocks that can accommodate wire sizes 14-22 AWG. Terminals shall be color coded

for power, input and outputs, and communication.

9. Power Supply: The power supply for the controller shall be 24 volts AC (-15%, +20%) power. Voltage below the operating range of the system shall be considered an outage.

K. VAV Specific Features:

1. Integrated Actuator: The controller shall have an integrated actuator with the following features:
 - a. The actuator shall be rated at 40 in-lbs.
 - b. Connection to the damper shall be with a v-bolt clamp, accepting 3/8" to 5/8" damper shaft sizes.
 - c. The actuator shall travel 0 to 95 degrees with adjustable end stops at 45 and 60 degrees of rotation.
 - d. The actuator shall travel at a rate of 90 degrees per 90 seconds if supplied by 60 Hz power; 90 degrees per 108 seconds if supplied by 50 Hz power.
 - e. The actuator shall have an integrated gear disengagement mechanism.
2. Integrated Pressure Sensor: The controller shall have an optional integrated pressure sensor for airflow measurement. The sensor shall have a range of 0-2"wc, consuming and accurate to 4.5% of reading or 0.0008"wc, whichever is greater.
3. Inputs: The controller shall have at the following inputs:
 - a. Inputs for room temperature and room setpoint from wall sensor.
 - b. Additional universal inputs, software configurable as analog or binary.
 - c. Actuator position feedback, via a potentiometer mechanically tied to the output coupler. Position information should be accurate even when the damper is moved manually (gear disengagement lever is depressed).
4. Outputs: The controller shall have the following outputs:
 - a. Damper Actuator, Clockwise and Counter-clockwise
 - b. Additional universal outputs, software configurable as analog or binary. Each output channel shall be capable of being manipulated individually, exclusive to any other output.
5. VAV Balancing: The VAV controller shall be capable of being balanced from the Digital Room Sensor without any specific pc-based software.

L. General Purpose Specific Features:

1. Mounting: The controller shall be able to be mounted on standard DIN rail or to a panel using integrated mounting holes on 1" centers.
2. Inputs:
 - a. Two dedicated inputs for room temperature and room setpoint from discrete wall sensor.
 - b. Eight universal inputs, software configurable as analog or binary.
3. Outputs:
 - a. Eight universal outputs, 0-12VDC software configurable as analog or binary. Each output shall be capable of supplying 100 mA with a limit of 300 mA for all universal outputs combined.
4. Modular Expandability: The controller shall allow expansion of the device Input and Output capacity via Expansion Modules, making it possible to add I/O as desired to meet the requirements for individual control applications.

2.7 DIGITAL ROOM SENSOR

- A. General: The Digital Room Sensor shall provide the following types of functions and be field

programmable:

1. Space condition measurements and indications, including temperature, humidity, local motion/occupancy, and CO2 as required by specific application.
 2. User setpoint adjustments
 3. Equipment status and mode indication
 4. Outside air temperature indication
 5. Capability to view the value of any input or output in the system
- B. Temporary Network Interface: The Digital Room Sensor shall provide a Temporary Network Interface jack, field accessible without uninstalling the sensor, for connection to the BACnet MS/TP communication trunk to which the BACnet AAC is connected. The Digital Room Sensor, the connected controller, and all other devices on the BACnet network shall be accessible through the temporary communication jack.
- C. Integrated Sensors: The Digital Room Sensor shall have integrated sensors for temperature, humidity, motion/occupancy, and CO2. The intent of this requirement is to minimize the number of physical devices installed in the zone. The Controls Contractor shall inform the Engineer or Record if multiple zone sensor devices will be required for zone sensing of temperature, humidity, motion/occupancy, and CO2. The Engineer of Record will coordinate with the Architect for review/approval of the multiple zone sensors.
- D. User Indicators: The Digital Room Sensor shall be capable of indicating the following at a minimum:
1. Fahrenheit, Celsius
 2. CFM, LPS
 3. Fan Status, Fan Speed (Low, Medium, High), Auto Fan, Heat Mode, Cool Mode, Auto Mode, Occupancy Mode, Override Mode
 4. Outside Air Temperature, Part Per Million, % Relative Humidity, Time (AM/PM)
 5. Rotational Values – Multiple values may be configured for display in the numeric display fields. If multiple values are configured, the display shall rotate through each point as a configurable rate.
- E. User Set points: User/Occupant set points may be manipulated via the Digital Room Sensor. Single and/or multiple set points shall be supported and field configurable. Unique set point sequences shall be configurable and presented to the user based on a mode condition. Setpoint adjustment shall be capable of being locked out at the Digital Room Sensor. Setpoints shall be adjustable at the BAS when locked out locally.
- F. Password Protection: The DIGITAL ROOM SENSOR shall have two levels of password protection: one level to protect user set point adjustment, and one level to protect configuration menu parameters. Passwords shall be at least 4 digits in length.

2.8 BACnet ROUTER

- A. General: The BACnet router shall route BACnet traffic between BACnet networks, virtual and/or physical. The router shall be designed for both permanent installations as well as temporary use for BACnet device configuration and BACnet network troubleshooting.
- B. Connections:
1. Power: The router shall be powered wither from 24VAC AC (-15%, +20%) or from USB. The 24VAC connections shall be a removable terminal block accepting 12 to 22 AWG wire.

2. USB: A micro USB connections shall be provided, supporting both temporary device power and device communications.
 3. Network Communication Ports: The controller shall have an on-board, 10/100bT Ethernet port and an EIA-485 port. The EIA-485 port shall be optically isolated and have integrated end-of-line (EOL) terminations. The EIA-485 port shall be a removable terminal block accepting 12 to 22 AWG wire.
- C. Mounting: The router shall be capable of being flush mounted via mounting holes on 1" centers, or DIN rail, without the use of additional mounting accessories.
- D. Configuration: The router shall be fully configured via integrated HTML5 based webpages, without the need for any specialized or PC based software. The router configuration may be exported to/imported from a local file via the configuration webpages.
- E. Communications: The router shall be a native BACnet device, available as EIA-485 (MS/TP) or Ethernet/IP physical connections as required.
1. MSTP: MSTP network baud rates between shall be selectable between 9600 and 115.2k baud. Segmentation shall be supported.
 2. Ethernet/IP: The following BACnet For devices enabled with Ethernet/IP connectivity, the user shall be able to select BACnet 8802-3, BACnet IP, BACnet BBMD, or BACnet Foreign Device. Segmentation shall be supported.
- F. Routing: The router shall support: one BACnet MSTP network, one BACnet 8802-3 network, and two BACnet IP networks, the IP networks selected able as IP, foreign devices or BBMD. The BBMD Foreign Devices table shall support up to 128 entries.
- G. Diagnostics
1. Device Status: The router shall report the status of each MSTP device that is detected on the MSTP network. MSTP MAC address status shall be indicated with the following color coded categories: no devices detected (white), offline (grey), router MAC (blue), active device (green), errors or duplicate (red). Metrics shall indicate the total device count online, average token cycle time, and the average token time per device.
 2. Token Use: The router shall report state of the MSTP token. The status of the token as it is passed between MSTP devices shall be indicated with the following color-coded categories: passed in less than 100ms (normal, green), passed in more than 100 ms but less than the APDU timeout (slow, yellow), passed in longer than the APDU timeout (red). Poll for Master (PFM) shall be indicated in light blue.
 3. Route Status: The router shall report all the known BACnet networks, both directly connected and remote connected. The status of each BACnet network should be identified, indicating the following network states: active, busy, down/gone, or duplicated network, duplicated MSTP MAC, sole MSTP master, BBMD: Unknown, BBMD: Multiple, Foreign Devices NAK.
 4. MSTP Metrics: The following MSTP network metrics shall be indicated: Tx Frame Count, Tx Data Count, TX Error Count, Rx Frame Count, Rx Unexpected Frame Count, Wait for Reply Error Count, Duplicate MAC Count, Token Retry Count, Token Timeout Count, Rx Token Count, Token Error Count, Rx PRM Count, PFM Error Count, Rx Discard Count, Rx FB Reparse Count.
- H. Time Master: The router shall be a BACnet time sync master, capable of syncing BACnet network time to either local (PC) or a SNTP Time server. Both UTC and local time shall be supported.

- I. Firmware Upgrades: The router firmware shall be upgradeable for updates as future enhancements and expanded functionality. Firmware updates shall be supported via BACnet communications (over-the-network) and through the integrated configuration webpages.

2.9 DIRECT DIGITAL CONTROL SYSTEM HARDWARE

- A. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be capacitor-driven fail-safe with switch-selectable direction providing consistent torque in both powered and fail-safe modes. The fail-safe option, on proportional models, can be turned off temporarily for testing purposes or permanently if desired. Damper actuators shall have gear disengagement button, and adjustable mechanical end stop. Proportional models shall include "anti-jitter" circuitry, optional auto-mapping of the full input signal range over a reduced actuator stroke, and switch selectable 0/1–5 or 0/2–10 VDC feedback. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
- B. Only VAV terminal unit control valves and fan coil unit control valves shall allow for fail-in-place control valve actuators. All other hot water control valves shall be Normally-Open arrangement. Chilled water control valves shall be Normally-Closed arrangement.
- C. Sensor Only Wall Mount Room Temperature sensors: Where shown on plans as sensor only, provide stainless steel flat plate temperature sensors. Flat Plate Sensors shall be Type III 10,000-ohm @ 77 degree thermistor type. These devices shall have an accuracy of ± 0.36 Degrees F.
- D. Duct-mounted and Outside Air Temperature Sensors: Type III 10,000-ohm @ 77 degree thermistor temperature sensors with an accuracy of ± 0.5 degrees F over the entire range. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -4 to 221 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air, preheat air, and other locations where air stratification might affect temperature readings, install bendable averaging duct sensors. Sensor element length shall be selected for sufficient coverage equal to one foot of sensor length for every two square feet or coverage area. These devices shall have accuracy of ± 0.5 degrees F over the entire range.
- E. Humidity sensors shall be a CMOS chip sensor providing excellent linearity, sensitivity, and reliability, accuracy to plus or minus two percent (2%) over the 10 to 90% RH, 10 - 15 VDC input voltage, analog output (0 – 5 VDC output). Operating range shall be 0 to 100% RH and 40 to 120 degrees F. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.
- F. Carbon Dioxide Sensors (CO₂): NDIR (Non-Dispersive Infrared) sensor, single beam with a patented self-calibration algorithm. Five year calibration guarantee (in auto-calibration mode), in compliance with CA Title 24, Section 121(c). Sensor default range shall be 0 - 2000 PPM but configurable up to 7,500 PPM. Accuracy shall be plus or minus 75 PPM @ 1000PPM @ 72 Degrees Fahrenheit. Response shall be less than two minutes. Input voltage shall be 20 to 28 VAC or DC. Choice of field-adjustable analog current or voltage output

signals (4–20 mA, 0–5 VDC, or 0–10 VDC), linearized over full range. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.

- G. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- H. Differential Analog (duct) Static Pressure Transmitters: Provide a pressure transmitter with switch-selectable pressure ranges (inches water column). Accuracy shall be plus or minus 1% of full scale range. Provide push button auto zero capability. Device shall have integral static pickup tube.
- I. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed pressure tips or compression fittings.
- J. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Indoor panels not subject to water damage shall be NEMA-1. Provide NEMA 3R panels for outdoor use or where subject to falling dirt, rain, sleet, snow, or external ice. In all cases where controls may be subject to windblown dust, splashing water, and hose-directed water, use NEMA-4 panels.
- K. Low Air Temperature Sensors: Provide SPDT type switch, with 34 to 70 degrees F range, vapor-charged temperature sensor. KMC model CTE-3017, or approved equivalent.
- L. Variable Frequency Drives: The variable frequency drive (VFD) shall be designed specifically for use in Heating, Ventilation, and Air Conditioning (HVAC) applications in which speed control of the motor can be applied. The VFD, including all factory installed options, shall have UL & CSA approval. VFD's shall include communications capability with DDC BAS via built-in interface card (BACnet) for information purposes. All control signals from VFD shall be controlled through direct, hardwired control signals (AO, BO, AI, BI).
- M. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall have indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
- N. Emergency Stop Switches: Provide toggle-type switch with normally-closed contact. Switch shall be labeled "EMERGENCY SHUTOFF".
- O. Transducers: Differential pressure transducers shall be electronic with three output ranges: 4 to 20 mA, 0 to 5 VDC, and 0 to 10 VDC. Device shall have the following: push-button and remote zeroing terminal, uni-directional or bi-directional pressure-range selection switch, high/low port swap switch to solve incorrect plumbing for differential, normal or slow-surge damping switch to prevent false alarms and reduce noise and output polarity reverse switch so in reverse mode the analog output is maximum when the pressure differential is zero and decreases as pressure increases. Unit shall be designed to operate in the pressure ranges involved.
- P. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 VA

minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.

- Q. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

2.10 BAS SYSTEM WEB BROWSER GUI - SYSTEM OVERVIEW

- A. The BAS Contractor shall provide system software based on thin-client architecture, designed around the open standards of web technology. The BAS Supervisory Server or SNC shall communicate using Ethernet and TCP. BAS shall be accessed using a web browser over Owner intranet and remotely over the Internet.
- B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
- C. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
1. Real time 'live' Graphic Programs.
 2. Trending.
 3. Scheduling.
 4. Parameter change of properties.
 5. Set point adjustments.
 6. Consolidated system reports
 7. Alarm / event information.
 8. Configuration of operators.
 9. Execution of global commands.
- D. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP).
- E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project. BAS software components shall include:
1. Server/SNC Software, Database and Web Browser Graphical User Interface.
 2. 1 Year Software Maintenance license. Labor to implement not included.
 3. Embedded System Configuration Utilities for future modifications to the system and controllers.
 4. Embedded Graphical Programming Tools.
 5. Embedded Direct Digital Control software.
 6. Embedded Application Software.

2.11 GRAPHICAL USER INTERFACE

- A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It

shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

- B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.
- C. Navigation: Navigation through the GUI shall be accomplished by selecting dynamic links to system graphics.
- D. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic view to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
 - 1. Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color.
 - 2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
 - 3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.
 - 4. Mechanical Systems: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
 - 5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
 - a. Each building.
 - b. Each floor and zone controlled.
 - c. Each piece of equipment monitored or controlled including each terminal unit.
- E. Hierarchical Schedules: An operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
 - 1. Schedules: Schedules shall comply with BACnet standards and shall allow events to be scheduled based on:
 - a. Types of schedule shall be Normal, Holiday or Override.
 - b. A specific date.
 - c. A range of dates.
 - 2. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic

level shall apply.

- F. Alarms: Alarms associated with a specific system or area shall be displayed in the 'Alarms' view. Alarms, and reporting actions shall have the following capabilities:
 - 1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a URL link to the associated graphic for the selected system or area.
 - 2. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
 - 3. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance.
 - 4. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
- G. Trends: As system is engineered, all critical points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously.
 - 1. Viewing Trends: The operator shall have the ability to view trends by using the BAS GUI. The system shall be able to simultaneously graphically display multiple trends per graph.
 - 2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server or SNC. Trend data, including run time hours and start time date shall be retained in non-volatile module memory.
 - 3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval.
 - 4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
- H. Security Access: Systems that Security access from the web browser GUI to BAS server or SNC shall require a Login Name and Strong Password. Access to different areas of the BAS system shall be defined in terms of Role-Based Access Control privileges as specified:
 - 1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
 - c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
 - 2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.12 GRAPHICAL PROGRAMMING

- A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
- B. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 GENERAL

- A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.
- C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.
- D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.4 WIRING

- A. All low voltage electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

- B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All control wiring shall be installed in conduit.
- C. Excess wire shall not be looped or coiled in the controller cabinet.
- D. Incorporate electrical noise suppression techniques in relay control circuits.
- E. There shall be no drilling on the controller cabinet after the controls are mounted inside.
- F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.
- G. Use manufacturer-specified wire for all network connections.
- H. Use approved optical isolation and lightning protection when penetrating building envelope.
- I. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.5 ACCEPTANCE TESTING

- A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative or Engineer or Record. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR TRAINING

- A. The Control System Contractor shall provide one day of comprehensive training for the Owner's representative to enable proficient operation of the system. Training shall be provided after final commissioning of the project.

3.7 TEST AND BALANCE ASSISTANCE

- A. The Control System Contractor shall provide up to 4 hours of training to the test and balance contractor on the use of test and balancing tool – provided by the Control System Contractor for adjusting of system setpoints needed to balance the system. If no tool is available, the Control System Contractor shall provide up to 24 hours of assistance to the test and balance contractor.

3.8 COMMISSIONING AGENT ASSISTANCE

- A. The Control System Contractor shall provide up to 40 hours of assistance to the Commissioning Agent during final commissioning inspection. If additional hours are necessary, the Control System Contractor shall provide an hourly labor rate to the Commissioning Agent for the purchase of additional assistance labor hours as necessary for the completion of the commissioning process.

- B. The Control System Contractor shall not make changes to the final control system design or sequence of operations without written approval from the Engineer of Record. Any proposed changes to the control system design shall be prepared and submitted in writing by the Commissioning Agent.

3.9 WARRANTY PERIOD SERVICES

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

3.10 WARRANTY ACCESS

- A. The Owner shall grant to the Control System Contractor reasonable access to the BAS during the warranty period. Remote access to the BAS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.11 OPERATION & MAINTENANCE MANUALS

- A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
 - 1. As-built control drawings for all equipment.
 - 2. As-built Network Communications Diagram.
 - 3. General description and specifications for all components.

END OF SECTION

SECTION 23 11 23

INTERIOR NATURAL GAS PIPING

PART 1 - GENERAL

- 1.01 This system shall consist of all gas piping as indicated on the drawings to a point five feet outside building indicated including distribution and connection to every gas appliance furnished, installed or connected under this contract.
- 1.02 All work to comply with the requirements of the gas utility company, local codes, NFPA Pamphlet No. 54, and other sections of these specifications.

PART 2 - PRODUCTS

- 2.01 Pipe shall be Schedule 40 black steel assembled with malleable iron or welded fittings. Use welded fittings on 2" and above.
- 2.02 Pipe below grade shall be coated and wrapped. Straight lengths shall be furnished with factory-applied electrically insulating coating. Fittings and damaged coating shall be wrapped with Tapecoat CT applied in accordance with manufacturer's latest printed instructions. Install anodes per utility and code.
- 2.03 REGULATORS:
- A. Appliance regulators shall be equal to Rockwell Gas Appliance Regulator. Model and size as applicable for capacity as indicated on drawings.
 - B. Pounds-to-ounce regulators shall be equal to Rockwell Service Regulators with full capacity internal relief. Model and size as applicable for capacity indicated on drawings.

PART 3 - EXECUTION

3.01 INTERNAL PIPING:

- A. Provide a gas cock and appliance regulator at each gas-using appliance.
- B. Provide steel sleeves under all concrete floors. Vent end of sleeve with pipe equal in size to gas line sleeved and protect with cap. Sleeve shall be a minimum of two pipe sizes larger than pipe.
- C. Piping shall be run in ventilated spaces. Lay-in type ceiling will be considered ventilated. Where pipes run in hollow walls, vent cavity at top and bottom.
- D. Vent each pound-to-ounce regulator to the outside.
- E. Install anodes and cathodic protection accessories as required by utility and code.

F. Piping to be painted yellow per architect.

3.02 TEST: After completion of work, and before backfilling, if required, the entire system shall be tested to an air pressure of 125 PSI for a period of two hours and proved tight by inspection. Furnish results of the tests, signed by the Contractor, to the Engineer.

END OF SECTION 23 11 23

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

- 1.01 HVC piping systems shall consist of refrigerant piping handling fluorocarbons.
- 1.02 Do not vent refrigerants to the atmosphere. Install new systems using recovering methods. Evacuate and recover existing systems to be modified or removed.
- 1.03 Submit piping materials, fittings, and refrigeration accessories

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING:

- A. Pipe: "K" copper. Soft-drawn may be used where bending is required on 1-3/8" O.D. and smaller. All other shall be hard-drawn; or Type "L" Copper, hard-drawn, marked "ACR" at Contractor's Option.
- B. Fittings: Wrought copper or forged brass for refrigerant use.

PART 3 - EXECUTION

3.01 REFRIGERANT PIPING:

- A. To be installed by machine mechanics skilled in this type work, and in accordance with recognized industry standards.
- B. Make joints with "Sil-Fos" backed with nitrogen.
- C. Piping and specialties to be sized and installed as recommended by the manufacturer of refrigerant piping.
- D. Pre-charged lines may be used with approval of Engineer. These lines shall be installed as recommended by the unit manufacturer. Check charge after installation.
- E. See Section 23 07 19 for insulation.
- F. Isolate piping from building structure to prevent transmitting equipment vibration.
- G. See Section 23 05 29 for hangers.
- I. Installation:
 - 1. Minimum Requirements: Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

2. Testing:

- a. General: Every refrigerant containing part of every system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively.
- b. Test Medium: Oxygen, or any combustible gas, or combustible mixture of gases shall not be used within the system for testing. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-relief device, and a gage on the outlet side. Set the pressure-relief device above the test pressure but low enough to prevent permanent deformation of the system components.
- c. System Test And Charging: Recommended by the equipment manufacturer or as follows:

- 1) Connect source or refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 10 psig. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
- 2) Connect a source of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Refer to Table For Test Pressures. Test entire system again for leaks.

- 3) Operating Pressures, PSIG: From ANSI B9.1.

Refrigerant	Low Side	High Side
R-407C	150	230

- 4) Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in microns. Pull the system down to 100 microns and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

END OF SECTION 23 23 00

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Duct liner insulation.

B. Related Sections:

1. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Factory- and shop-fabricated ducts and fittings.
2. Fittings.
3. Penetrations through fire-rated and other partitions.

C. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

- a. McGill AirFlow LLC.
- b. SEMCO Incorporated.
- c. Sheet Metal Connectors, Inc.
- d. Spiral Manufacturing Co., Inc.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G60.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches

2.04 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

- B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width:[3 inches 976mm)].
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

- D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.

5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.05 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:

- a. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa): or Higher. Test representative duct sections totaling no less than 30 percent total installed duct area for each designated pressure class.
 - b. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 30 percent total installed duct area for each designated pressure class.
- 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before applying external insulation.
 - 5. Conduct tests at static pressures equal to maximum design pressure of system or sections being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 6. Give seven days' advance notice for testing.

3.07 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.08 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

- B. Supply Ducts:

- 1. Ducts Connected to Fan Coil Units, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.

- C. Return Ducts:

1. Ducts Connected to Fan Coil Units, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - e.
- D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg (250 Pa).
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- E. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Aluminum Ducts: Aluminum.
- F. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - c. Velocity 1500 fpm or Higher:

- 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, [12 Inches] and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, [14 Inches] and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire/smoke dampers
7. Flange connectors.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: [G60].
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. NCA Manufacturing, Inc.
 - 7. Ruskin Company.
 - 8. SEMCO Incorporated.
 - 9. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity 3000 fpm
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: 0.052-inch- thick, galvanized sheet steel.

- F. Blades: Multiple single-piece blades, pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked.
- I. Blade Axles:
 - 1. Material: Galvanized steel.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 5. 90-degree stops.

2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Ruskin Company.
 - g. Trox USA Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized -steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Ruskin Company.
 - g. Trox USA Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 1-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.04 CONTROL DAMPERS

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

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Duro Dyne Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. METALAIRE, Inc.
8. NCA Manufacturing, Inc.
9. Ruskin Company.

B. Frames:

1. [Galvanized] steel channels, 0.064 inch thick.
2. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Parallel- and opposed -blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Oil-impregnated bronze.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.05 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. McGill AirFlow LLC.
 - 4. METALAIRE, Inc.
 - 5. NCA Manufacturing, Inc.
 - 6. Prefco; Perfect Air Control, Inc.
 - 7. Ruskin Company.
 - 8. Vent Products Company, Inc.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to [4-inch wg] static pressure class and minimum [4000-fpm] velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, [165 deg F] rated, fusible links.

2.06 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Pottorff.
 - 6. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.

- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
- E. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- (1.6-mm) thick, galvanized sheet steel.
- F. Leakage: Class I
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.039-inch- (1.0-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- I. Damper Motors: Two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Accessories:
 - 1. Auxiliary switches for position indication.
 - 2. Test and reset switches, damper mounted.

2.07 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Pottorff.
 - 6. Ruskin Company.

- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
- F. Heat-Responsive Device: Resettable, 165 deg F (74 deg C) rated, fire-closure device.
- G. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- (1.6-mm-) (0.85-mm-) thick, galvanized sheet steel.
- J. Leakage: Class I.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: Modulating two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- P. Accessories:
 - 1. Auxiliary switches for position indication.

2. Test and reset switches, damper mounted.

2.08 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ductmate Industries, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.09 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Ductmate Industries, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation.
 5. McGill AirFlow LLC.
 6. Ventfabrics, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
- C. Pressure Relief Access Door:
 1. Door and Frame Material: Galvanized sheet steel.

2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at pressure to be determined by Engineer.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip [3-1/2 inches] wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 1. Minimum Weight: 26 oz./sq. yd..
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.

2.11 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft or control dampers as shown at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire , to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts with maximum [12-inch] lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

O. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire to verify full range of movement and verify that proper heat-response device is installed.

END OF SECTION 23 33 00

SECTION 23 74 00
PACKAGED OUTDOOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged rooftop units and commercial packaged gas/electric

1.2 REFERENCES

- A. Safety Standards:
 - 1. Underwriters Laboratories (UL).
 - 2. Underwriters Laboratories of Canada (ULC).
 - 3. National Electric Code (NEC).
 - 4. Canadian Electric Code (CEC).
- B. Air-Conditioning, Heating and Refrigeration Institute (AHRI):
 - 1. AHRI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
 - 2. AHRI 370 Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.
 - 3. AHRI 210/240 Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- C. All models are ASHRAE 90. 1-2007 compliant
- D. ISO 9001, Manufacturing Quality Systems

1.3 PERFORMANCE REQUIREMENTS

- A. 5, 13, 15, 20, 25 ton capacity
- B. Electrical Characteristics
 - 1. 60 Hz
 - 2. 208 v – 3 Phase

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures
- B. Product Data: Submit product data for specified products
- C. Shop Drawings:
 - 1. Submit shop drawings in accordance with Section [01 33 00 - Submittal Procedures]
 - 2. Indicate:
 - a. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections
 - b. Piping, valves and fittings shipped loose showing final location in assembly
 - c. Control equipment shipped loose, showing final location in assembly

- d. Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads
 - e. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers
 - f. Fan performance curves
 - g. Details of vibration isolation
 - h. Estimate of sound levels to be expected across individual octave bands in db
 - i. Type of refrigerant used
 - j. Plan view, front view end view, back view and curb detail with dimensions
- D. Quality Assurance:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements
 - 3. Manufacturer's Instructions: Manufacturer's installation instructions
- E. Manufacturer's Field Reports: Manufacturer's field reports specified herein
- F. Closeout Submittals: Submit the following:
 - 1. Warranty: Warranty documents specified herein
 - 2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers
 - 3. Provide brief description of unit, with details of function, operation, control and component service
 - 4. Provide equipment inspection report and equipment operation test report
 - 5. Commissioning Report: Submit commissioning reports, report forms and schematics in accordance with Section 01 81 00 – Commissioning.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project
 - 2. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings).

1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays
- C. Packing, Shipping, Handling and Delivery:
 - 1. Deliver materials in manufacturer's original, unopened, undamaged containers with

- identification labels intact
- 2. Ship, handle and unload units according to manufacturer's instructions
- D. Storage and Protection:
 - 1. Store materials protected from exposure to harmful weather conditions
 - 2. Factory shipping covers to remain in place until installation

1.7 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Warranty Bond: Commencing on Date of Installation
 - 1. Limited 15 years optional Stainless Steel Heat Exchanger
 - 2. Limited 5 years on compressors
 - 3. Limited 3 years on Coil System
 - 4. Limited 3 years on Unit Controller
 - 5. Limited 5 years on High Performance Economizers
 - 6. Limited 1 year all other covered components

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP UNITS

- A. Acceptable Manufacturers:
 - 1. Lennox Industries
 - 2. Trane
 - 3. Daikin
- B. General:
 - 1. Capacity
 - a. 3-6, 7.5-12.5, 13-25 tonnages
- C. Proprietary Products/Systems:
 - 1. Cabinet:
 - a. Heavy gauge steel panels
 - b. Pre-painted steel panels
 - c. Full perimeter heavy gauge galvanized steel base rail
 - d. Rigging holes on all four corners
 - e. Forklift slots (on three sides, not directly below condenser coil) on base rail
 - f. Raised or flanged edges around duct and power entry openings
 - g. Airflow Choice:

1. 3 to 12.5 ton units are shipped in downflow, configuration can be field converted to horizontal air flow with optional Horizontal Discharge Kit
2. 13 to 25 ton units are available in downflow or horizontal return air flow configuration
 - a. Horizontal airflow requires Horizontal Roof Curb
 - b. Horizontal Return Air Panel Kit is also required if converting a downflow configuration into horizontal
- h. Electrical lines and gas lines can be brought through the base (optional feature) of the unit or through horizontal knockouts
- i. Insulation:
 1. All panels adjacent to conditioned air are fully insulated with non-hygroscopic fiberglass insulation
 2. Unit base is fully insulated
 3. Unit base insulation also serves as air seal to the roof curb
- j. Access Panels: Hinged for compressor/controls/heating areas, blower access and air filter/economizer access; and, sealed with quarter-turn latching handles and tight air and water seal
- k. Exterior panels constructed of heavy-gauge galvanized steel with two layer enamel paint finish
- l. Corrosion resistant double sloped condensate Drain Pan
- m. Service Valves
2. Cooling System:
 - a. Refrigerant type: R-410A
 - b. Capable of operating from 0 to 125° F (-18 to 52° C) without installation of additional controls
 - c. Compressors:
 1. Scroll Type
 2. Resiliently mounted on rubber mounts for vibration isolation
 3. Overload Protected
 4. Internal excessive current and temperature protection
 5. Isolated from condenser and evaporator fan air streams
 6. Refrigerant cooled
 - d. Crankcase heaters
 - e. High capacity filter/driers
 - f. High pressure switches
 - g. Low pressure switches
 - h. Freezestats
3. Coil Construction:
 - a. Tube and fin condensing/evaporator coil general construction:

1. Aluminum Rippled and Lanced fins
2. Copper tube construction
3. Aluminum fins mechanically bonded to copper tubes
4. All coils are high pressure leak tested at manufacturing facility
- b. Environ condensing coil general construction:
 1. Aluminum/Aluminum construction
 2. Aluminum Lanced fins
 3. Aluminum fins thermally bonded to aluminum flat tube
 4. All coils are high pressure leak tested at manufacturing facility
- c. Evaporator Coils:
 1. With balanced port thermal expansion valves, freeze protection on each compressor circuit, pressure and leak tested to 500 psi
 2. Each compressor circuit on coil divided by rows that are active across the entire surface area of the supply air on all models
 3. [With flexible immersed coating electrodeposited by dry film process, meets standards: Military Specification MIL-P-53084, ASTM B117 and ASTM 1153]
4. Wiring:
 - a. Keyed and labeled field connections, color coded and continuously marked wire to identify point-to-point component connections
 - b. Not in contact with hot-gas refrigerant lines or sharp metal edges
5. Gas Heating System:
 - a. Induced draft
 - b. Natural gas fired system with direct spark ignition
 - c. Electronic flame sensors
 - d. Flame rollout switches
 - e. High heat limit switches
 - f. Induced draft failure switch and capable of operating to altitude of 2000 feet (610 m) with no derate to manifold pressure
 - g. Service access for controls, burners and heat exchanger
 - h. Heat Exchanger:
 1. Tubular Design
 2. Stainless steel
 - i. Gas piping system tight and free of leaks when pressurized to maximum supply pressure
 - j. Gas Valve: redundant type gas heat valve with manual shutoff
 - k. Single stage gas heating, Two stage gas heating: See HVAC equipment schedule
 - l. Gas Burners: Aluminized steel inshot-type gas burners
 - m. Direct spark pilot ignition
 - n. Fan and Limit Control

- o. Safety Switches
- p. Gas piping system tight and free of leaks
- 6. Heating Controls:
 - a. Support 2 stages of heating control from thermostat or DDC
 - b. Delay time of 30 seconds between low and high heat stages
- 7. Supply Air Fan Motor and Drives:
 - a. Belt drive
 - b. Permanently lubricated ball bearings (for belt drive motors)
 - c. Thermal overload protected motors with automatic reset
 - d. Adjustable sheaves on belt drive motors for blower speed adjustment
 - e. Optional low and high static motor/drive combinations and optional drive kits
 - g. Variable Air Volume (VAV)
- 8. Supply Air Fan:
 - a. Double inlet type, galvanized steel with forward curved blades
 - b. Statically and dynamically balanced
 - c. Continuous or automatic control for occupied periods
- 9. Supply Air Filters:
 - a. 2" MERV 8 Filter
- 10. Condenser Fan Motor:
 - a. EC motors on all models.
 - b. Direct drive with permanently lubricated ball bearings.
 - c. Watertight with thermal overload protection and automatic reset
 - d. Motor mount isolated from fan safety guard
- 11. Condenser Fans:
 - a. Corrosion resistant propeller type
- 12. Unit Controller:
 - a. Solid state control board to operate unit
 - b. Scrolling digital display
 - c. Mobile app navigation and programming
 - d. Guided menu setup
 - e. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard
 - f. Shall provide and display alarms, alarm history and system status
 - g. Component and cooling/heating mode run test capability
 - h. Shall accept input from a CO2 sensor
 - i. Economizer control
 - j. Blower on/off delay

- k. 2-stage heat/4-stage cool compatible
- l. Warm-up mode
- m. DDC compatible
- n. Indoor air quality input
- o. Low ambient control down to 0°F
- p. Component runtime and cycle count data collection
- q. Blower proving switch strike 3
- s. Real time clock (timestamps)
- t. USB interface with profiles and firmware upgrade capability
- u. Economizer Fault Detection and Diagnostics
 - i. CO2 sensor error
 - ii. Outside Air Temperature sensor error
 - iii. Discharge Air sensor error
 - iv. Actuator over voltage
 - v. Actuator under voltage
- v. Controls Options:
 - 1. Dirty Filter Switch: Factory
 - 2. Blower Proving Switch: Factory
 - 3. Phase/Voltage Monitoring Protection: Factory
 - 4. BACnet: Factory
 - 5. Smoke detector supply: Provided by Electrical Contractor.
 - 6. Smoke detector return: Provided by Electrical Contractor.
 - 7. Supply Air Control: Factory
 - a. 5 adjustable airflow settings
 - b. Auto-calibration
 - c. Supply airflow CFM & Motor RPM/torque monitoring
 - d. Low supply CFM & No Airflow diagnostics
 - e. Customizable alarms
 - 8. Ventilation Air Control: Factory
 - a. Ventilation CFM
 - b. Auto-calibration
 - c. Dynamic damper control
 - d. Ventilation airflow CFM & % Outside Air monitoring
 - e. Low/High Ventilation CFM % Free cooling fault diagnostics
 - f. Customizable alarms
- w. BACnet MS/TP and BACnet IP connectivity

14. Accessories:

- a. Economizer downflow:Hoods provided Factory
- b. High Performance Economizer downflow
 - i. Outside (fresh) Air damper Max Leakage Rate: 4 CFM/sq. ft. at 1" w.g.
 - ii. Return Air Max Leakage Rate: 4 CFM/sq. ft. at 1" w.g.
 - iii. Damper Reliability: 60,000 cycles minimum
 - iv. Economizer fault detection and diagnostics
 - (a) Outside Air Temperature sensor error
 - (b) Discharge Air sensor error
 - (c) Actuator over voltage
 - (d) Actuator under voltage
- c. Economizer control: Differential Dual Enthalpy: Factory
- d. Roof curb: Field
- e. Barometric relief damper downflow
- f. Hail Guards: Field
- g. Disconnect Switch: Factory
- h. Condensate drain trap plastic: Factory
- i. GFCI Service Outlets (field wired) Factory

2.2 PRODUCT SUBSTITUTIONS

- A. Substitutions: Substitutions permitted upon approval of the Engineer.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer's SPEC-DATA® sheets.

3.2 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Install packaged rooftop units in accordance with manufacturer's instructions. On roof curbs provided by manufacturer as indicated.

END OF SECTION

SECTION 26 00 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic electrical requirements specifically applicable to Divisions 26, 27, 28 sections in addition to applicable Division 01 sections of the Specifications. The Engineer (or Architect) shall herein be the A/E.

1.2 COORDINATION

- A. The electrical work shall be installed in cooperation with other trades installing inter-related work. Coordinate all conduit runs to miss mechanical ducts as shown on mechanical sheets and at building.
- B. Anchor bolts, sleeves, inserts, and supports shall be installed by this subcontractor.
- C. Contact Engineer three days prior to pouring of slabs to verify floor outlet locations. Obtain dimensioned drawings from the Architect for floor outlet positioning.

1.3 SUBMITTALS

- A. Deviation from the Drawings and Specifications shall be called to the attention of the Architect in writing at the time of submission of the Shop Drawings. The Engineer's checking of any drawing shall not release the subcontractor from responsibility for such deviations.
- B. The Contractor shall furnish complete sets of certified Shop Drawings. Provide submittals for Lighting, Switchgear, electronic systems, wiring devices and other items as noted in other sections of the specification.
- C. Where equipment requiring different arrangement of connections from those shown is approved, it shall be the responsibility of the subcontractor to install the equipment to operate properly and in harmony with the intent of the Contract Documents, and to make all changes in the work required by the different arrangement of connections and pay all charges resulting from changes.
- D. Submittals shall include physical dimensions of electrical equipment.

1.4 CODES, ORDINANCES, INSPECTIONS AND PERMITS

- A. Obtain and pay for required fees, permits, and inspections for electrical work.
- B. Perform Work in accordance with N.E.C., N.F.P.A., U.L., local codes and N.E.C.A. (latest version).

1.5 DELIVERY, STORAGE AND HANDLING

- A. Place stored materials on clean, hard surfaces above ground and keep covered at all times to ensure protection from paint, plaster, dust, water and other construction debris or operations.
- B. Keep conduit ends plugged or capped, and all covers closed on boxes, panels, switches, fixtures, etc., until installation of each item.
- C. Stored materials and equipment shall be located to facilitate prompt inspection.

1.6 ACCURACY OF DATA

- A. The data given herein and on the Drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Exact locations, distances, levels, etc., will be governed by the building, and the Contractor shall use the data contained herein with this understanding.
- B. The Contractor shall verify all measurements at the building and shall be responsible for the correctness of same. No extra compensation will be allowed because of differences between work on the Drawings and measurements of the building.

1.7 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. The intent of the Electrical Drawings and Specifications is that the subcontractor shall furnish all labor and materials, equipment and transportation necessary for the proper execution of the work. This subcontractor shall thoroughly examine the Drawings and Specifications relating to other trades in order to include all necessary work in his bid. No additional payments shall be considered for failure to properly interpret the responsibilities to other trades. The subcontractor shall do all the work shown on the Drawings and described in the Specifications and all incidental work necessary to complete the Project in a substantial and acceptable manner, and to fully complete the work ready for use, occupancy, and operation by the Owner. The A/E reserves the right to make any reasonable changes up to six feet (6') in the locations indicated without additional cost to Owner.

1.8 OPERATING AND MAINTENANCE MANUALS

- A. Deliver to the A/E for the Owner's use, two complete operating and maintenance manuals covering all equipment and systems installed by this Division.
- B. Include approved equipment and material submittals, parts lists, wiring diagrams, and operating instructions for all operating equipment.
- C. Bind brochures in hard back three ring binder and tab indexed. Label front cover and back spine indicating project name. Include page showing data and local responsible vendors with addresses and telephone numbers and furnishing parts and information on equipment.

1.9 OBSERVATION OF WORK

- A. The A/E will make final onsite review of the Work of this division, prepare punch list, and visit the job site to check the punch list.
- B. If additional trips are required to the job because the Contractor did not perform the work as shown and called for on the punch list, then the Contractor shall reimburse the A/E for charges at the rate of \$175.00 per hour plus 55 cents per mile for travel expenses.
- C. The Contractor shall allow the Engineer access to all parts of the Work and shall furnish assistance and information as required by the Engineer.

1.10 PROJECT RECORD DRAWINGS

- A. The Contractor shall provide as-built drawings. Record all deviations from plans, actual locations of underground utilities etc.

1.11 INSPECTION OF SITES

- A. Inspect the site and become thoroughly familiar with conditions to be met and the work to be accomplished. At existing building sites verify prior to bid all conditions shown affecting work.

1.12 SAFETY AND WORK METHODS

- A. Refer to General Conditions.
- B. The Electrical Subcontractor is completely responsible for how all of his work is performed; safety, in, on, or about the job site; methods of performance;

and timeliness in such performance. In the event he is unsatisfied with the performance of other trades, he shall set forth such complaints in writing for the Owner's review. In no event shall this subcontractor expect to be specifically directed in the protection of personnel or material by the Owner, Architect, or Engineer.

1.13 NOISE AND VIBRATION CONTROL

- A. Isolate noise generating equipment and all equipment mounted to building including A/C units, ballast, etc., with flexible conduit to prevent transmission of noise through conduit system.

1.14 PAINTING

- A. Repair finish surfaces damaged by Work of this section.
- B. Paint equipment and material furnished and installed under this section that has only a prime coat of paint. Use color and brand of paint selected by Architect.
- C. All "exposed to view" conduit, boxes, panels, etc. to be primed and painted with color selected by Architect. Verify prior to painting.

1.15 TEMPORARY CONSTRUCTION POWER

- A. This Contractor shall furnish and install temporary construction power wiring as required. Temporary electrical service shall be obtained in the name of the General Contractor, and it will be the General Contractor's responsibility to pay all power company charges. The temporary service shall be obtained from the local utility company. Provide temporary lighting as required for adequate illumination for construction and safety purpose.

1.16 LICENSING REQUIREMENT

- A. No person shall perform electrical work on the contract without possessing an Arkansas State Master or Journeyman License from the Arkansas State Electrical Examiners Board. All electrical work and apprentice electricians shall be supervised as required by State law.
- B. All electricians shall have a copy of their license with them and shall be required to show it to an appropriate inspector upon request.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

- A. In order to establish standards of quality, the Engineer has referred to certain products by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equivalent or better design. Where multiple manufacturing sources are shown on the Drawings or herein specified, the subcontractor shall limit his bid to one of those manufacturers.
- B. Electrical fixtures, appliances, hardware, switch gear, panel boards, boxes and other items related in any manner to electrical work shall be considered; however, it will be at the discretion of the Architect and the electrical engineer to evaluate "equal" as a substitution to that as specified. It will be the responsibility of the bidder for the substituted item's approval. Should item be deemed "not equal" by the Architect and electrical engineer, then the bidder must supply the item as specified without additional cost to the Owner or any design team member.
- C. The subcontractor shall abide by the Engineer's judgment when proposed substitute materials or items of equipment are judged to be unacceptable and shall furnish the specified material or item of equipment in such case. All proposals for substitution shall be submitted in writing by the General Contractor and not by the Electrical Subcontractor or material suppliers. The Engineer will approve or disapprove proposed substitutions in writing. If any request for a substitution is rejected, the Contractor shall automatically furnish material specified. All materials shall be new and shall bear the manufacturer's name and the Underwriters Laboratory label. Materials of the same general type shall be the same throughout the job to provide uniform appearance, operation, and maintenance.
- D. **Delivery and Storage:** Equipment and materials shall be delivered to the site and stored in original containers. All items subject to moisture damage (such as coils of dry transformers) shall be stored in dry, heated space. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect. Damage or defects developing before acceptance of the work shall be made good at no expense to the Owner.

2.2 LABELING

- A. Each major component of equipment shall have a nameplate listing the manufacturer's name, address, catalog and serial number. The nameplate shall be brass, aluminum or other durable material attached to the equipment in a conspicuous location. Nonferrous identifying tags or pressure-sensitive labels shall be provided for all cables, feeders, and power circuits in vaults, pull boxes, manholes and switchboard rooms at cable termination and in other locations.
- B. Tags or labels shall be stamped or printed to correspond with markings on the as-built drawings so that feeder or cable may be readily identified. Electrical equipment, safety switches, time clock, starters, panels and transformers shall have black and white laminated bakelite nameplates securely fastened to device with screws and be exposed. Edge of plates shall be beveled. Letters shall be white with black field. Letters shall be 3/8-inch upper case. Nameplate shall state its purpose and the voltage of the equipment. 120 or 240 volt equipment shall have black; 480 volts red.
- C. Provide "Flash Protection" label as per NEC.
- D. PROVIDE LOCATION "DOTS" ON CEILING TILES WHERE LIGHTING CONTROL DEVICES ARE LOCATED. VERIFY WITH THE ARCHITECT PRIOR TO INSTALLATION.

2.3 FLASHING

- A. For roof penetrations, furnish penetration as approved by roofing company.

2.4 ACCESS PANELS

- A. Furnish access panels as required to service electrical devices.
- B. Furnish size and type as required for proper service or as shown on Drawings for specific locations.

2.5 WIRING NOT IN RACEWAY

- A. Where the Drawings or Specifications allow communication system wiring to be run without raceways, the Contractor shall supply plenum-rated wire where wiring penetrates air plenums, whether indicated or not.

2.6 ARRESTORS

- A. Where a data, telephone, fire alarm, intercom or similar cable is specified for the project; provide arrestors at all cable entrances as per code.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

- A. Provide cutting and patching required to perform the electrical work. Do not cut structural members except through explicit instructions of the Architect/Engineer. Accomplish patching with workmen skilled in the trade required. Perform cutting and fitting in rough construction phases of the work.

3.2 FIRE STOPPING

- A. When wiring or conduit penetrates a rated wall this contractor shall provide a fire rated sealant or system equal or great than the fire rating of the wall. This includes sealing sleeves that are used for low voltage cables. Seal after cable installation. This includes cables installed by owner if installed prior to completion of the project. If the owner has not installed cables by end of project provide proper capping methods.

3.3 ACCESSIBILITY

- A. Install in an accessible location, all junction boxes, starters, relays, light fixtures, and other items that may require servicing or repairing.

3.4 CLEARANCES

- A. Maintain clearances in front of electrical equipment as required by code. Report discrepancies to A/E PRIOR TO ROUGH-IN.
- B. Submit ½" = 1'-0" scale plan showing layout of electrical equipment.

3.5 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Excavate and trench as required to install portion of the electrical systems required to be located below grade. Arrange cutting of streets and walks with governing authorities and patch cuts to conform to their requirements.
- B. Protect roots of trees designated to remain. Perform trenching within the branch spread by hand. When trench is opened, install the utility immediately, prune injured roots cleanly, and backfill as soon as possible.

- C. Keep trenches free from water while construction therein is in progress. Conduct discharge from dewatering to drains or natural drainage channels.
- D. Backfill trenches only after required electrical system tests have been completed. Backfill and tamp in 6-inch layers with materials free of large stones or clods of earth to cover of 12 inches. Backfill the remainder of trenches in 12-inch layers. Do not use blasted rock, broken concrete or large boulders for backfill. Backfill entire depth of trenches to be covered with roads, walks, or concrete slabs in 6 inch layers, compacting each layer to 95 percent of maximum dry density at or near optimum moisture content as determined by Standard Proctor procedures, ASTM D698.
- E. Ensure that buried lines have a minimum of 30-inch cover. Install marking tape above all feeder conduits ,telephone and data lines. Do not install utility lines beyond 2 feet from the building until rough grading is completed. Allow for finished grading operations to ensure adequate final cover over lines.

3.6 WIRING

- A. Electrical wiring for mechanical equipment or equipment furnished by others is separated into two main wiring divisions: (1) Power wiring by Electrical Contractor and (2) Control wiring by Mechanical Contractor.
- B. Power wiring shall be the energy source and shall include installation of circuit protective devices, controller, conduit, wiring, and safety disconnects from power supply, and terminating at the motor or appropriate terminals on equipment. Install starters as required.
- C. Control wiring shall comprise conduit and wiring not included in power wiring or noted above. This wiring shall include low voltage automatic temperature control wiring, safety and interlocking wiring, push button starting, pilot light, and signal wiring, etc., that is not included as part of safety equipment.
- D. The Electrical Contractor shall install all wiring and equipment specifically shown on the Electrical Drawings.
- E. All telephone, data and similar wiring shall be permanently marked. In addition a wiring schedule shall be placed on the as-builts.

3.7 CONNECTION OF EQUIPMENT NOT SPECIFIED IN THIS DIVISION

- A. Provide necessary materials and make connections to equipment requiring electrical power.
- B. Rough-in for connection of this equipment according to shop drawings furnished with the equipment or by actual measurements taken from equipment on site. Provide junction boxes, disconnect switches, etc., required to properly connect each piece of equipment unless specifically stated otherwise.

3.8 UTILITIES LOCATIONS, METERS, AND CONNECTIONS

- A. Arrange with proper authorities and utility companies for service connections, verifying locations and arrangements. Pay all costs of service as shown and provide all required conduits, meter bases wiring for indicated service. Contact the serving utility prior to bid and include all cost of utility services in bid.
- B. When connections to existing lines, rerouting of utility lines, modifications to services, etc., would interrupt service or interfere with normal use of the buildings, arrange work such that outages are minimized and schedule outages to occur at times satisfactory to the Owner.
- C. Before ordering equipment and proceeding with Work, verify with the utility company existing or available voltages shown on Drawings. If voltage differs from that noted on the Drawings and in the Specifications; notify the Engineer immediately.
- D. Transformers: Locate utility transformer pads so as to provide code (and Utility) required clearances from building. Verify prior to bid.

3.9 APPEARANCE OF WORK

- A. Arrange and install exposed portions on Work specified under this division such as devices, fixtures, panels, and safety switches to fit in and harmonize with Work specified in other divisions.
- B. Run conduits concealed in chases, attics or cable trenches unless indicated otherwise. Run conduit exposed to view in mechanical rooms and electrical equipment rooms.
- C. Run conduit parallel or perpendicular to building lines.

3.10 TESTS

- A. Test panel feeders, motor circuits, and conductors larger than #6 with a 600 volt Megger to prove insulation resistances.
- B. Test grounding electrode system to verify compliance with N.E.C. requirements.

3.11 GUARANTY PERIOD

- A. Electrical Contractor shall warrant equipment furnished and work performed for a period of one year from date of written acceptance of work. This guarantee shall cover patching, refinishing, etc., required to restore faulty condition at no additional expense to Owner.

3.12 CLEANING

- A. At completion of work, clean and polish fixtures, equipment, and materials.

3.13 CONFLICT

- A. If there is a conflict between Drawings and Specifications, provisions of the most stringent shall control. Drawings and Specifications are complementary; work required by one, but not required by the other, shall be performed as though required by both.

3.14 MOTOR CONNECTIONS

- A. Wherever equipment requiring electrical connection is specified, power wiring shall be furnished and installed under applicable sections of Electrical Division of Specifications. Starting switches, protective devices, and other means for operation and control of equipment shall be furnished under applicable equipment sections but shall be installed under applicable electrical section, unless specifically noted otherwise on Drawings. Additional disconnects required by National Electrical Code shall be furnished, installed, and connected by Electrical Contractor. Motor terminals or equipment connections shall terminate in a junction box or disconnect adjacent to equipment. See Mechanical Plan for exact location of motors.
- B. Install conduit and boxes for thermostats. Obtain count and location from mechanical Drawings. Extend conduit from thermostat box to equipment. If

thermostat conduits are shown to be included under the mechanical section then that section shall take precedence.

END OF SECTION

PRE-FINAL PROJECT OBSERVATION CHECK LIST

Complete this form and forward to the Engineer's office three business days prior to the requested Final Project Observation date.

Forward this form to: Lucas, Merriott & Associates
 rdmerriott@merriotteng.com

	ITEM	YES	NO
1.	Polarity of all receptacles shall be tested. GFI receptacles shall be tested. *		
2.	Test all emergency lighting by turning circuit breakers off.		
3.	Provide typed panel directories.		
4.	Obtain certification letter from Fire Alarm Vendor indicating the system has been tested and is fully operational.		
5.	Clean fixture lenses and reflectors.		
6.	Provide Owner with spare lamps, parts, keys, etc. as specified for this project.		
7.	All junction boxes shall have covers and shall be labeled with the circuit number(s).		
8.	Clean all switchgear and provide designation label.		
9.	Remove paint from all devices and device plates.		
10.	Replace all burned out lamps.		
11.	Megger test reports (attach with this form)		
12.	Ground and bonding connections to cold water pipe, building steel, ground rods, etc.		

*test with ECOS #1019 or similar tester

All of the items must be met prior to the Final Project Observation.

Requested Final Project Observation date: _____

Signature of Electrical Contractor: _____

SECTION 26 05 19

WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Feeders and branch circuits larger than 10 AWG: stranded conductor, 600 volt insulation, THW or THHN/THWN. Conduit sizes are based on THWN. Wiring shall have UL listing and markings on insulation. Use THHN where fluorescent fixture channel is used as wireway. Wire sizes shown are based upon copper conductors unless noted as "AL".
- B. Stabiloy may be used for feeders and services that exceed 800 amps. Adjust wire size to match copper rating. Aluminum is not permitted except as noted here or specifically on the plans.
- C. Feeders and branch circuits 10 AWG and smaller: Solid conductor, 600 volt insulation THHN/THWN.
- D. In general armored cable is not permitted. Where wiring is run in wood studs the contractor may use armored cable for 20 amp branch circuits with the permission of the engineer.

2.2 COMMUNICATION SYSTEM WIRING

- A. Wiring type and size for communication (nurse call, intercom, bell systems) and fire alarm systems shall be as recommended by equipment manufacturer. In no case shall any circuit carrying a load have less more than 3% voltage drop. Contractor shall check Drawings and provide plenum-rated wiring where wiring penetrates air plenums and is allowed by the Drawings or Specifications to not be run in raceway.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, no smaller than 14 AWG for control wiring other than that listed above. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet. For longer runs consult Engineer for required sizes.
- B. For parallel feeders; place an equal number of conductors for each phase of a circuit in same raceway or cable and make conductor lengths the same.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Completely and thoroughly swab raceway system before installing conductors.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

3.3 COLOR CODING

- A. Color code wiring as per code.

3.4 CIRCUITING

- A. **Circuit as shown on Drawings.** Failure to properly circuit according to Drawings shall result in rewiring as directed at no increase in Contract Sum. Contact Engineer for resolutions of circuiting conflicts. If duplicate circuit numbers are found on the plans contact the Engineer prior to rough in. Allow for spare room in all conduits by not filling to more than 60% of that allowed by NEC.

END OF SECTION

SECTION 26 05 26

SECONDARY GROUNDING

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment to metallic water service where applicable and to supplementary grounding electrodes.
- B. Ground each separately-derived system neutral to nearest effectively grounded metallic water pipe where applicable or nearest effectively grounded building structural steel member.
- C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and piping systems.
- D. Do not connect neutral and ground anywhere except at service entrance.
- E. Do not use conduit as the sole grounding method.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ground Rods: Copper-encased steel, 3/4-inch diameter, minimum length 10 feet.
- B. Furnish BURNDY bar connectors or CADWELD connectors.
- C. Provide a concrete encased grounding electrode for the main grounding electrode

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide a separate, insulated equipment grounding conductor in feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing.
- B. Connect grounding electrode conductors to metal 1-inch water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- C. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Connect grounding system to nearest structural steel member.
- D. Provide a #6 AWG minimum copper conductor for communications service grounding conductor. Leave 10 feet slack conductor at telephone terminal board. Provide grounding as directed in Telecommunications section if included.
- E. Isolated Grounding Systems: Use insulated equipment grounding conductor and connect only at panel ground bus. Use isolated ground receptacles.

3.2 FIELD QUALITY CONTROL

- A. Leave grounding points exposed for inspection – Provide box with cover for inspection port.

END OF SECTION

SECTION 26 05 33a

CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Raceways

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

- A. Allied, Triangle or approved equal.
- B. Quick connect type rigid steel couplings not permitted.

2.2 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: FS WW-C-566; steel or aluminum.
- B. Fittings and Conduit Bodies: Use clamp or compression type ANSI/NEMA FB 1. Screw in type not allowed.

2.3 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

- A. Conduit: Flexible metal conduit with PVC jacket.
- B. Fittings and Conduit Bodies: Use compression type connectors; screw in type not allowed. ANSI/NEMA FB 1.

2.4 PLASTIC CONDUIT AND FITTINGS

- A. Conduit: Carlon or equal.

2.5 ARMORED CABLE – Refer to the Wiring section for permitted uses.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for conductor type installed, minimum size 3/4-inch. Conduit sizes shown on Drawings are based on THWN. Provide spare capacity in all branch circuits by not filling to more than 60% of the NEC allowed conduit fill.
- B. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers. Arrange conduit to maintain headroom and present a neat appearance.
- C. Group conduit in parallel runs where practical.
- D. Do not fasten conduit with wire or perforated pipe straps or piggy back type clamps. Remove all wire used for temporary conduit support during construction before conductors are pulled.
- E. Conduit and conduit bodies including, FS & FD or larger cast or sheet metal boxes, are not permitted to be supported by either a ceiling grid wire and/or the ceiling grid itself, via any conduit or conduit body clips which may include but would not be limited to: t-bar and/or ceiling wire conduit clips.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square using saw; de-burr cut ends and bring conduit to the shoulder of fittings and couplings and fasten securely.
- B. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- C. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
- D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- F. Provide pull strings in all empty conduits.
- G. Install expansion joints where conduit crosses building expansion joints and every 75 feet.

- H. Where conduit penetrates fire-rated walls and floors, provide fire-stop fittings with UL listed fire rating equal to wall or floor rating.
- I. Install four spare 3/4-inch conduits from each flush mounted power panel to an accessible point above ceiling and cap off.
- J. Use long radius elbows on telephone conduit over 1-inch size.
- K. Where installed on top of a roof do NOT use wood supports. Provide a UV protected high density polypropylene base UL listed for the purpose. Use a section of roof membrane below the support to protect the roof. Use stainless steel vertical supports and unistrut to create a trapeze. Use a galvanized roller hanger or band for the pipe. Optionally use Cooper Industries "Dura-Blok" systems with a protective membrane between the roof and the blocks.

3.3 CONDUIT INSTALLATION SCHEDULE

- A. Galvanized rigid steel: Minimum 3/4-inch size may be used in all areas.
- B. Electrical Metallic Tubing: Minimum 3/4-inch size may be used in indoor dry locations where it is:
 - 1. Not subject to damage, not in contact with earth, not in concrete slabs on grade and in compliance with other qualifications in this section.
- C. Schedule 40 PVC may be run for underground branch circuits and feeders.
- D. Flexible steel conduit: 1/2-inch minimum; use for final connection to recessed fluorescent light fixtures and mechanical equipment; length not to exceed four feet. Support independently of the box.
- E. Liquid-tight flexible steel conduit:
 - 1. Use for outdoor final connections to mechanical equipment, length not to exceed four feet.

END OF SECTION

SECTION 26 05 33b

BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pull, junction, and outlet boxes.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2-inch male fixture studs where required. Use 4x4 deep type box with single gang mud ring for telephone and data outlets.
- B. Cast Boxes: Cast ferrous alloy, deep type, gasketed cover, threaded hubs.

2.2 FLOOR BOXES AND WALL BOXES

- A. On grade floor boxes shall be Wiremold Evolution Series EFB45S-OG multiservice box unless noted otherwise. Provide a complete assembly matching box to floor type and trip to floor covering type. Include all internal components for wiring to be installed. Unless noted otherwise include ports for data, HDMI, duplex receptacle and telephone.
- B. Provide Wiremold: EFSB4 for wall mounted TV's and for connections to Lecturn. Include cover in bid price unless noted otherwise. Each box shall have a duplex receptacle, data port, HDMI and coax. Where used as a lecturn box extend a 2" conduit to above ceiling for low voltage cables.
- C. For boxes on floors above ground level where the slab does not permit the box noted above use the Wiremold Evolution Series Poke through multi service box. Unless stated otherwise bid the 6" as a minimum but insure it is large enough for all requirements indicated on the plans.
- D. Obtain exact mounting location for these boxes from Architect.

2.3 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

- B. Cast Metal Boxes for Outdoor and Wet Locations Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- C. Cast Metal Boxes for Underground Installations: NEMA 250; Type r, outside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

PART 3 - EXECUTION

3.1 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance. Electrical box locations shown on Drawings are approximate unless dimensioned.
- B. Mount switches and pull stations 48 in (center of box) above finish floor and receptacles 16 inches (center of box) above finish floor. Mount clock outlets 12 inches below ceiling. Strobes 80" AFF.
- C. Refer to architectural plans prior to rough in. Coordinate the architectural plans with that shown on the electrical plans. If there are discrepancies, obtain correct rough in locations prior to work. Verify with the architect the exact locations of all wall mounted devices. If this is not done the contractor shall move them as directed by the architect for no additional cost. In general light switches shall always be located near the door strike side jam unless there are sidelight. Where there are sidelights – confirm the location.

3.2 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24-inch separation in acoustic and fire rated walls. Separate phone/data and power by 12 inches.
- B. Provide knockout closures for unused openings.
- C. Support boxes independently of conduit except for cast boxes that is connected to two rigid metal conduits, both supported within 12 inches of box.

- D. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- E. Install outlets mounted above counters, benches, and backsplashes according to millwork plans.
- F. Position lighting outlets as per reflected ceiling plans.
- G. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening. NO boxes shall be installed in inaccessible areas.
- H. Secure boxes to interior wall and partition studs with 8-32 bolts or weld. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- I. Align wall-mounted outlet boxes for switches, thermostats, and similar devices. Set switch boxes within 6 inches of door jamb where applicable.
- J. Provide cast outlet boxes in exterior locations exposed to the weather and wet locations.

3.3 FLOOR BOX INSTALLATION

- A. Set boxes level and flush with finish flooring material. Install floor boxes as directed by Arch. **Obtain exact dimensions from Architect prior to rough in.**

END OF SECTION

SECTION 26 05 48

SEISMIC PROTECTION

PART 1 - GENERAL

1.1 GENERAL

- A. The requirements for seismic protection measures to be applied to electrical equipment and systems specified herein are in addition to any other items called for in other sections of these specifications. Electrical equipment shall include the following items to the extent required on plans or in other sections of these specifications:

- 1. Light fixtures
- 2. Switchboards (floor mounted)

1.2 CONDUIT NOT REQUIRING SPECIAL SEISMIC RESTRAINTS

- A. Seismic restraints may be omitted from the following installations:
- B. All electrical conduit less than 2 1/2" inside diameter
- C. All conduit suspended by individual hangers 12" or less in length from the top of pipe to the bottom of the support for the hanger.

1.3 SHOP DRAWINGS

- A. Shop drawings along with catalog cuts, template, and erection and installation details, as appropriate, for the items listed below shall be submitted. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

PART 2 - PRODUCTS

2.1 BOLTS AND NUTS

- A. Squarehead bolts and heavy hexagon nuts: ANSI B1 8.2.1 and B1 8.2.2, and ASTM A307 or A576.

- B. Bolts, underground: ASTM A325

2.2 SWAY BRACE

- A. Materials used for member listed in Table I of this specification shall be structural steel conforming with ASTM A36.

PART 3 - EXECUTION

3.1 SWAY BRACE

- A. Sway brace shall be installed on conduit not otherwise rigidly anchored to preclude damage during seismic activity. Bracing shall conform to approved arrangements. Provisions of this paragraph apply to all conduit within a 5'-0" line around outside of building unless buried in the ground. Hanger rods shall be increased in cross sectional area proportionate to the increased weight per linear foot of pipe and contents supported at each trapeze hanger. No trapeze-type hanger shall be secured with less than two 1/2" bolts.
- B. TRANSVERSE SWAY BRACING: Transverse sway bracing shall be provided at intervals NOT TO EXCEED 30'-0".
- C. LONGITUDINAL SWAY BRACING: Longitudinal sway bracing shall be provided at 40'-0" intervals.
- D. VERTICAL RUNS: Vertical runs of conduit shall be braced at not more than 10'-0" vertical intervals.
- E. ANCHOR RODS, ANGLES, AND BARS: Anchor rods, angles, and bars shall be bolted to either conduit clamps at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified hereinafter. Anchor rods, angles, and bars shall not exceed lengths given in Table I.
- F. BOLTS: Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2" diameter.

TABLE I
MAXIMUM LENGTH FOR BRACING MEMBERS

TYPE	SIZE	MAXIMUM LENGTH*	ALLOWABLE LOADS* (Kips)
ANGLES	1-1/2" x 1-1/2" x 1/4"	4'-10"	5.7

SEISMIC PROTECTION

	2" x 2" x 1/4"	6'-6"	7.8
	2-1/2" x 1-1/2" x 1/4"	8'-0"	9.8
	3" x 2-1/2" x 1/4"	8'-10"	10.8
	3" x 3" x 1/4"	9'-10"	11.9
RODS	3-4"	3'-1"	3.7
	7-8"	3'-8"	5.0
FLAT BARS	1-1/2" x 1/4"	1'-2"	3.1
	2" x 1/4"	1'-2"	4.1
	2" x 3/8"	1'-9"	6.2
PIPES (40S)	1"	7'-0"	4.1
	1-1/4"	9'-0"	5.5
	1-1/2"	10'-4"	6.6
	2"	13'-1"	8.9

* Based on the slenderness of $1/r = 200$ and ASTM A36 steel.

3.2 SPREADERS

- A. Spreaders shall be provided between racked or adjacent conduit runs to prevent contact during seismic activity whenever surfaces are less than 4" apart or four times the maximum displacement due to seismic force. Spreaders to be applied at same interval as sway braces.

3.3 ANCHOR BOLTS

- A. All floor or pad mounted equipment will have a minimum of four anchor bolts securely fastened through base. Two nuts shall be provided on each bolt. Anchor bolts shall have an embedded straight length equal to at least 10 times the nominal diameter of the bolt and shall conform to the following Tables of sizes for various equipment weights, in accordance with ASTM A325 and A576.

MAXIMUM EQUIPMENT WEIGHT (POUNDS)	MINIMUM BOLT SIZES* (INCHES)
500	3/8
1,000	1/2
5,000	5/8
10,000	3/4
20,000	7/8
30,000	1
50,000	1-1/4
100,000	1-1/2

* Based on four bolts per item, use equivalent total cross sectional areas when more than four bolts per item are provided. Anchor bolts that exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

- B. When height-to-width ratio of the equipment exceeds 8.9, overturning must be investigated.

3.4 EQUIPMENT SWAY BRACING

- A. Equipment sway bracing shall be provided for all items supported from overhead floor or roof structures. Braces shall consist of angles, rods, bars, or pipes run at a 45° angles.

3.5 LIGHTING FIXTURES IN BUILDING

- A. In addition to the requirements of the preceding paragraphs, lighting fixtures and supports will conform to the following:

3.6 MATERIALS AND CONSTRUCTION

- A. Fixture supports shall be malleable iron.
- B. Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.
- C. Recessed fluorescent individual or continuous row fixtures shall be supported by a seismic resistant suspended ceiling support system and shall be bolted thereto at each corner of the fixture; or shall be provided with fixture support wires attached to the building structural members using 2 wires for individual fixtures and 1 wire per unit of continuous row fixtures.
- D. A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 4" boxes, 3" plaster rings, and fixture studs.
- E. Surface mounted fluorescent individual or continuous row fixtures shall be attached to a seismic resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner or the fixture.

- F. Each wall mounted emergency light unit shall be secured in a manner to hold the unit in place during a seismic disturbance.
- G. TESTS: In lieu of the requirements for equipment supports, lighting fixtures and the complete fixture supporting assembly may be tested as specified hereinafter. Such tests shall be conducted by an approved and independent testing laboratory, and the results of such tests shall specifically state whether or not the lighting fixture supports satisfy the requirements given herein.
 - 1. TEST EQUIPMENT: To simulate earthquake motion, fixtures and supports shall be attached to a carriage suspended on rollers from an overhead track. A gear motor and crank assembly shall be used to provide oscillatory motion of approximately 1 cycle per second. The exact number of cycles per second and the actual dimension of the crank apparatus shall be adjusted to produce a minimum carriage acceleration of 0.28 g. The actual fixture mounting surface shall be on the underside of the carriage and shall provide capacity for orienting the fixture in a horizontal plane in various positions ranging from parallel to perpendicular to the line of traverse.
 - 2. TEST REQUIREMENTS: All tests shall be conducted with the maximum fixture weight so as to produce the most severe loading conditions. Fixtures having stems shall be tested with the actual stem lengths to be used. Tests shall be of 1 minute duration with the mounting surface in the line of traverse, at 45° to the line of traverse, and at 90° to the line of traverse. A total of 2 fixtures shall be tested in each of the above positions. After each of the 6 tests, the complete stem assemblies from fixtures having stem assemblies shall be subjected to a tensile strength test. The sample shall withstand, without failure, a force of not less than 4 times the weight it is intended to support.
 - 3. ACCEPTANCE: No component of a fixture nor its supports shall be accepted individually. For acceptance, the fixture and its supports shall exhibit no undue damage, and no component of the fixture shall fail or fall from the fixture during testing.

3.7 RECESSED LIGHTING FIXTURES

- A. Recessed lighting fixtures not over 56 pounds in weight and suspended and pendant hung fixtures not over 70 pounds in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts.

END OF SECTION

SEISMIC PROTECTION

SECTION 26 24 00

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Panelboards and switchboards.

1.2 SPARE PARTS

- A. Keys: Furnish two for each panel to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Square 'D', Siemens, Eaton/Cutler Hammer. Use bolted circuit breakers .

2.2 MAIN AND DISTRIBUTION PANELBOARDS

NOTE: ALL MAIN PANELS AND SERVICE DISCONNECTS SHALL HAVE TVSS. Main breakers 1200 amps and above shall have ERMS option. Verify panel fit prior to ordering.

- A. Enclosure: NEMA 1 indoors; NEMA 3R outdoors. Provide doors with cylinder locks on all panels.
- B. Molded Case Circuit Breakers: NEMA AB 1; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits and HID/SWD for all breakers used to switch lighting circuits. Verify breakers for A/C equipment prior to rough-in. Provide G.F.I. type circuit breakers for all heating cable and immersion heaters.
- C. All main disconnect devices located inside shall have shunt trip operators.
- D. All flush mounted panelboards shall fit in 6" nominal stud wall.
- E. Where buildings are sprinklered furnish shunt trip breakers for elevator drives and control power (connected via the fire alarm to shut off power prior to sprinkler activation. Provide one auxilliary contact to shut off car

emergency battery power as well. Coordinate with the fire alarm vendor and elevator supplier.

- F. ALL KITCHEN RECEPTACLES SINGLE AND THREE PHASE SHALL HAVE GFI PROTECTION AT EITHER THE RECEPTACLE IF IT REMAINS ACCESSIBLE OR AT THE BREAKER. RECEPTACLES UNDER KITCHEN HOODS WITH FIRE PROTECTION SHALL BE SHUNT TRIP AND CONNECTED TO SUPPRESSION SYSTEM. GFI PROTECTION SHALL CONFORM TO THE LATEST NEC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards plumb and flush with wall finishes in conformance with NEMA PB 1.1 unless noted as surface-mounted. Provide filler plates for unused spaces in panelboards.
- B. Provide typed circuit directory under plastic for each branch circuit panelboard. The circuit directory shall indicate the load served. Circuits feeding lighting and receptacles shall be labeled as per which room is served (use owner's room naming system).
- C. Stub four empty 3/4-inch conduits to accessible location above ceiling out of each recessed panelboard.
- D. Meter Centers: Exterior conduits shall be painted. Paint color as selected by the Architect. Each conduit shall be stenciled with suite number or letter. Painted lettering shall be in contrast with Architect selected color. Label each meter with suite number or letter using bakelite label riveted to the equipment. Arrangement of meter sections shall be as indicated on the drawings unless permission is granted by the Engineer.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall switches, receptacles and plates.

1.2 SUBMITTALS

- A. Submit product data showing configurations, finishes, dimensions, and manufacturer's instructions. **Note if contractor does not request color selection from Architect he shall change all devices and plates as directed by Architect.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hubbell, Leviton unless shown otherwise.

2.2 WALL SWITCHES

- A. Wall switches shall be commercial grade.
- B. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: NEMA WD 1; AC general use snap switch with toggle handle, rated 20 amperes and 120-277 volts AC-**Color as selected by Architect.**
- C. Pilot Light Type: (light on with load on) used to indicate a load is on (e.g. remote exhaust fan).
- D. Lighted Toggle Type: (light on with load off) used to locate switch where it may be difficult to find in the dark.
- E. Manufacturer Catalog Numbers as listed in table below:

2.3 RECEPTACLES

- A. Receptacles shall be specification grade heavy duty unless otherwise shown on the drawings.
- B. Convenience and Straight-blade Receptacles: NEMA WD 1 - 20 Amp: 5-20R, one piece ground strap construction - **Color as selected by Architect.**

- C. GFI Receptacles: 20 Amp duplex convenience receptacle with integral ground fault current interrupter. Slaving of GFI's not permitted unless shown otherwise. Provide GFI protection for all receptacles in kitchens. In addition provide GFI receptacles at all locations within 6' of a water outlet.
- D. Tamper Resistant. Install commercial grade tamper resistant devices as defined and as required by code. **VERIFY LATEST CODE REQUIREMENTS.**

2.4 WALL DIMMERS

- A. Wall Dimmers: Dimmers shall be compatible with the LED (or other) fixtures specified. **Color as selected by Architect. Note; all devices on a project shall be from one vendor if possible so that color etc matches.**

2.5 WALL PLATES

- A. Cover plates – **302 Stainless Steel shall be standard.** If desired by Architect (confirm prior to submittals) a nylon plate can be used. Color as selected by Architect. Submit stainless plates unless directed otherwise in writing by the architect. If plastic plates are substituted without specific change proposal request the contactor shall replace with stainless steel. **VERIFY PLATE TYPE PRIOR TO ORDERING**
- B. Weatherproof Cover Plate: Thomas & Betts, "In use" Red-Dot "Code Keeper". Complete unit shall be made of die cast copper-free* aluminum alloy including flip cover. Plastic units are not acceptable. (*less than .004 copper content). Flip lid types are permitted only where allowed by code.
- C. Furnish blank plates for openings without a device.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install receptacle behind E.W.C. so cord will not show. Provide GFI protection for all water cooler outlets. This can be a GFI breaker or slaved and properly labeled from a bathroom GFI receptacle.

END OF SECTION

SECTION 26 28 00

DISCONNECT SWITCHES

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 MANUFACTURERS - DISCONNECT SWITCHES

- A. Square D, Eaton, Siemens

2.2 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1; Heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Handle lockable in OFF position. Fuse Clips: FS W-F-870, designed to accommodate Class R fuses with solid neutral. General duty may be used for A/C disconnects under 100 amps.
- B. Nonfusible Switch Assemblies: NEMA KS1; Type HD; FS W-S-865; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Handle lockable in OFF position. General duty may be used for disconnects under 100 amps.
- C. Enclosures:
 - 1. NEMA 1: Indoors.
 - 2. NEMA 3R: Outdoors.
 - 3. As indicated on Drawings.
- D. Provide auxiliary contacts on disconnects for elevators to disconnect the emergency let down option.

2.3 MANUFACTURERS - FUSES

- A. Bussman: Fusetrons for motors, Low Peak or Hi-Cap elsewhere and at service.

2.4 FUSES

- A. Fuses 600 Amperes and Less: ANSI/UL 198E, Class Low Peak. as indicated on Drawings; dual element, current limiting, time delay, 200 or 600 volt as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on Drawings and as required by code. Install a disconnecting means within sight of all motors (whether shown or not).
- B. Install heavy duty switches for service entrances and 100 amps and above.
- C. If switches are mounted on equipment, provide 12 inches of flexible conduit next to switch between switch and panel.
- D. In locating disconnects for mechanical and other equipment the electrical contractor shall coordinate carefully with the other trades and insure that disconnects do not get mounted behind mechanical or other equipment. Insure Code required clearances are maintained.

END OF SECTION

SECTION 26 41 00

LIGHTNING PROTECTION SYSTEMS

PART 1 – GENERAL

1.1 Summary:

- A. Provide a complete lightning protection system for the building(s) or structures included on the contract drawings. The design of this system is to be in strict accordance with this section of the specifications and all contract drawings that apply. Provide a **Master Labeled** system
- B. The lightning protection system shall be installed by a firm actively engaged in the installation of Master Labeled Lightning Protection Systems and shall be so listed by Underwriters Laboratories Inc. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association's Lightning Protection Standard, NFPA 780.
- C. The work covered under this section of the specification consists of furnishing labor, materials and services required for the completion of a functional and unobtrusive lightning protection system approved by the architect, engineer and Underwriters Laboratories Inc.

1.2 References

- A. The completed lightning protection system shall comply with the latest issue of the following standards and form a part of this specification.
 - 1. a. NFPA 780, Standard for the Installation of Lightning Protection Systems.
 - 2. b. UL 96A, Installation Requirements for Lightning Protection Systems

1.3 Submittals:

- A. Detailed shop drawings shall be submitted to the architect and engineer for approval prior to commencement of the installation. Shop drawing are to show the extent of the system layout designed specifically for the building(s) or structures included in the contract drawings along with details of the products to be used in the installation.

PART 2 – PRODUCTS

2.1 Standard

- A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by UL 96A and NFPA 780 and shall be labeled or listed by Underwriters Laboratories Inc. for use in lightning protection systems. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment.

2.2 Acceptable Manufacturers

- A. Harger Lightning & Grounding
- B. Thompson Lightning Protection
- C. Robbins Lightning, Inc.
- D. Other vendors may submit for approval 10 days prior to bid and an addendum will be issued if the vendor is acceptable.

2.3 Materials

- A. Class I materials shall be used on structures that do not exceed 75 feet in height and Class II materials shall be used on structures that are 75 feet or higher above average grade.
- B. Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.
- C. Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

2.4 Air Terminals

- A. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Flat or gently sloping roofs exceeding 50'-0" in width shall be protected with additional air terminals located at intervals not exceeding 50'. Air terminals shall be located within two feet of roof edges and outside corners of protected areas.

- B. Air terminals shall be installed on stacks, flues, mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.
- C. Air terminal bases shall be securely fastened to the structure in accordance the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.
- D. Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees nor have a radius of bend less than 8 inches.
- E. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors.
- F. In case of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals not exceeding 100 feet along the perimeter of the structure.

2.5 Roof Penetrations

- A. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

2.6 Ground Terminations:

- A. Ground electrodes shall be copper clad steel and a minimum 5/8" diameter and 10 feet long. A ground electrode shall be provided for each down conductor. The down conductor shall be connected to the ground electrode using a bronze ground rod clamp having a minimum of 1 1/2" contact between the ground electrode and the conductor measured parallel to the axis of the ground electrode, or by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).
- B. Where the structural steel framework is utilized as the down conductor for the system, ground terminals shall be connected to columns around the perimeter of the structure at intervals averaging not more than 60 feet apart. Columns shall be grounded using either bonding plates having 8 square inches of surface contact area or by Ultraweld exothermically welded connections.
- C. All ground electrodes shall be interconnected with a ground loop conductor on structures that exceed 60 feet in height. The ground loop conductor shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor.

2.7 Equipotential Grounding

- A. Common interconnection of all grounded systems within the building shall be ensured by interconnecting to the lightning protection system. This interconnection shall include but is not limited to the electrical service, telephone and antenna system grounds as well as all underground metallic piping systems including water, gas and sewer. Interconnection to a gas or water line shall be made on the customer's side of the meter.
- B. Grounded metal bodies located within the required bonding distance as determined by the bonding distance formula in the latest edition of NFPA-780 Standard for the Installation of Lightning Protection Systems shall be bonded to the lightning protection system using the required bonding conductors and connections.

PART 3 – EXECUTION

3.1 Installation

- A. The installation shall be installed by an UL listed lightning protection installation company and member of LPI.

- B. For new construction, conductors shall be concealed. For existing structures, exposed conductors are only allowed with the Permission of the Project Architect.**

3.2 Coordination

- A. Coordinate the installation of the lightning protection system with other trades
- B. Coordinate all roof penetrations, fasteners and adhesive with the roofing contractor prior to installing any materials on the roof.

3.3 Inspection and Certification

- A. New Structures:
 - 1. Upon completion of the installation of the lightning protection system the contractor shall furnish the UL Master Label issued by Underwriters Laboratories Inc.

END OF SECTION

PART 1. GENERAL**1.1 SECTION INCLUDES**

- A. SPDs for electrical power service at the Main Switchboard, Emergency Panels and Branch Circuit Panels.

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 can 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).
- D. Substitutions are permitted as long as they meet the specification requirements.

1.3 COMPLIANCE REQUIREMENTS

- A. UL 1449, 4th Edition listing as a Type 1 SPD with a 20KA nominal discharge current.
- B. UL 1283 listing for EMI/RFI filters

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 where shown on the riser: SPD shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Tested surge current capacity of 150,000 amps per protection mode (L-N & L-G). SPD shall be a **Current Technology Model SL3-125**. If a 100-amp breaker is not specified in the panel for connection to the bus, use the integral disconnect in the SPD.
- D. SPD where shown on the riser: SPD shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Tested surge current capacity of 150,000 amps per protection mode (L-N & L-G). SPD shall be a **Current Technology Model CG150**. Use a 100-amp breaker in the panel for connection to the bus.

- E. SPD where shown on the riser: SPD shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Tested surge current capacity of 100,000 amps per protection mode (L-N & L-G). SPD shall be a **Current Technology Model CG100**. Use a 100-amp breaker in the panel for connection to the bus
- G. Each SPD unit shall be capable of surviving at least the following Category C3 (20KV, 10KA) impulses without failing or degrading the UL 1449 surge suppression rating more than 10%:

Main Panel MDP	14,000 impulses
Emergency Panel EDP	5,500 impulses
Panels HDP & LDP	4,500 impulses
Branch Circuit Panels	3,250 impulses

- H. Main Switchboard SPD shall be capable of protecting the loads from the damaging effects of temporary over-voltages and voltage swells as defined by ANSI/IEEE Standard 1100-2005 (the Emerald Book) at 160% rated nominal voltage and a 1,000 amps for 30 cycles.
- I. Diagnostic Monitoring System: Each SPD shall include an audible alarm system, Form C Contacts, and phase indicator smart lights which change color based upon percentage of protection remaining.

2.2 WARRANTY

- A. The SPD system shall have a **TWENTY 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 chase nipple to the panel, directly across from the connection breaker with minimum lead length.
- B. Have a factory-authorized representative inspect installation and verify that the SPD system 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 50 00

LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Luminaires and accessories.

1.2 SUBMITTALS

- A. Submit product data including **color chips**, support points, weights, and accessory information for each luminaire type.

1.3 QUALITY ASSURANCE

- A. Furnish interior ceiling fixtures compatible with ceiling system. Coordinate with ceiling system installer. Verify prior to ordering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - LUMINAIRES AND ACCESSORIES

- A. See Fixture Schedule on Drawings.
- B. All request for substitutions shall be accompanied by factory certified computer printouts of performance of substituted fixture showing foot candles on Floor Plan.
- C. All LED color temperatures shall be the same for all fixtures on the project. Verify color prior to bidding if it affects pricing. Verify prior to ordering.

2.2 LIGHTING POLES

- A. Provide fuses in pole at hand hole for each ballast.
- B. All poles shall have full base cover and galvanized anchor bolts.
- C. All poles shall be 7 gage. Minimum rating shall be for 80 MPH winds.

2.3 LIGHTING CONTROLS (relay panels, wireless systems etc.)

- A. Where shown on the plans provide a complete lighting control system. For relay panels use Leviton Green Max. The panel and accessories shall form a complete system as required to meet state energy codes. The system shall have all the relays required for the circuits controlled plus a minimum of 5 spares. Include a time clock, photocell input and photocell, network connections if required, factory startup and follow up programming visit. Programming shall be by the factory representative. Program the system as directed by the owner. Also provide instruction to the Owner in its operation and programming. For wireless systems provide similar features as noted above. Include in cost follow up programming after the owner has moved in for six months.
- B. Provide auxiliary contactors in enclosure as required for multi pole loads.
- C. Cable type and number of conductors shall be as recommended by the manufacturer. Cables between devices and panels shall be unspliced.

2.4 OCCUPANCY SENSORS

- A. Ceiling mounted occupancy sensors shall be Leviton or approved equal. Do not use ultrasonic sensors where interference with interactive boards is anticipated. The vendor shall submit a factory approved layout for review during the submittal stage and shall guarantee the layout for proper function. Provide power packs and auxiliary relay contacts as required for switching arrangement shown. Adjust each sensor as recommended.
- B. Wall mounted occupancy sensors shall be Leviton series or approved equal. Adjust each sensor as recommended.
- C. Locate sensors so that there is full room coverage. Provide additional sensors if required for irregular rooms or where pendant mounted fixtures obstruct the sensor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Connection to light fixtures shall be from j-box directly to fixture (fixture to fixture wiring not permitted except where fixtures are run in continuous runs such as lighting coves).
- B. Support surface-mounted luminaires directly from building structure. Support lay in fixtures according to Code.
- C. Layout work to ensure that ceiling outlets are located symmetrically in area.
- D. Luminaire Pole Bases: Size and constructed as indicated on Drawings. Provide galvanized anchor bolts and project anchor bolts 3 inches minimum above base. Install poles on bases plumb; lock into place as directed by manufacturer. Grout around pole base. In traffic areas base shall extend 30 inches above pavement.
- E. Arrange fixtures to miss ducts and equipment in Mechanical Room and to miss air ducts in other areas.
- F. Each pole shall be furnished with pole base cover whether indicated on the fixture schedule or not.

3.2 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

3.3 **As-Built: Provide permanent frame mounted maps of all lighting control devices such as relays, power packs etc that are above ceilings. Also provide an electronic version.**

END OF SECTION

SECTION 27 30 00

TELECOMMUNICATION RACEWAY SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Provide a complete raceway system for telecommunications. Cabling etc not in this contract. Refer to plans for additional information.

PART 2 – PRODUCTS

2.1 BOXES AND CONDUITS

- A. Unless noted otherwise on the drawings, telecommunication outlet boxes shall be 4" square by 2-1/8" deep with single gang plaster ring. Extend 1" conduit from telecommunications outlet box to above accessible ceiling area. Conduit ends shall be outfitted with a plastic bushing prior to the installation of cables.
- B. Include in the bid provision for the boxes and conduits required for card access to the room. Verify prior to work.
- C. Conduits entering the phone room from above the rack shall penetrate a minimum of 2" into the closet. If from floor extend to 4" AFF.
- D. Provide blank filler module for any unused openings.
- E. If not shown otherwise on plans provide a minimum of two 4" conduits from the service point on the site to the data closet. If not shown on the plans assume the furthest point on the site for bid purposes then verify with the service company. Use long sweep bends. Include pull boxes or manholes to keep the maximum number of 90 degree bends to two. Terminate these conduits in a pull box on the site. Include pull strings and cap the conduits on both ends to be water proof.

2.2 PLYWOOD BACKBOARDS

- A. Each Telecommunications Room shall have 3/4" AC grade plywood floor to ceiling on all walls (finished side out).

2.3 GROUNDING

- A. Each telecommunication rack shall be grounded via a #4 insulated conductor to grounding plate.

2.4 POWER REQUIREMENTS

- A. Unless shown otherwise on plans include a minimum of two 20A/120 circuits and two quad receptacles just to feed the data rack. Locate as directed by owners vendor. Include service outlets on all walls fed by an additional dedicated circuit.

2.5 Smoke detection

- A. If there is a building fire alarm system include smoke detection in the room.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation of all equipment shall comply with EIA/TIA 568 and the latest addition of the NEC.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. At the time of bid, all exceptions taken to these Specifications, all variances from these Specifications and all substitutions of operating capabilities or equipment called for in these Specifications shall be listed in writing and forwarded to the consulting engineer. Any such exceptions, variances, or substitutions which were not listed at the time of bid and are identified in the submittal shall be grounds for immediate disapproval without comment.
- B. Installation company shall be licensed by the State of Arkansas in accordance with ACA 17-33-101 et.seq., and shall have been in business minimum 5 years installing fire alarm systems. In addition the equipment and materials shall be provided by a franchised distributor. Technicians must be factory trained. Submit copy of training certificate with submittals.

1.2 SYSTEM DESCRIPTION

- A. Provide complete fire alarm system of the general alarm horn/strobe type. The system shall include but not be limited to the following:
 - 1. Addressable analog intelligent fire alarm control panel.
 - 2. Annunciator panel. Locate as directed by Fire Department.
 - 3. Manual fire alarm stations.
 - 4. Smoke detectors.
 - 5. Alarm horns and flasher horns.
 - 6. Visual alarm lights - ADA rated (visual devices to have mutli-candela settings within a single unit as manufactured by Wheelock or approved equal).
 - 7. Central station alarm and trouble connection. Provide cellular dialer and internet communication.

8. Standby battery backup.

1.3 APPLICABLE CODES AND STANDARDS

- A. All equipment shall be U.L. and FM listed for its intended use.
- B. IBC Section 907 Fire Alarm and Detection Systems and NFPA.
- C. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - Article 760).
- D. The system equipment and its installation shall comply with all other local codes and authorities having jurisdiction.

1.4 ELEVATORS AND MACHINE ROOMS

- A. If there is an elevator and sprinkler system on the project; the fire alarm system shall activate shunt trip breakers for the elevator controls and motors and open the sprinkler pre-action valve as directed by the state elevator inspector. In addition make provisions to open the power to the emergency let down circuit if supplied in the shunt trip arrangement if emergency power is supplied.
- B. Install smoke detectors in all enclosed elevator lobbies, machine rooms and in the hoistway. Interface these with the elevator control system.
- C. Provide elevator recall for all buildings as directed by the AHJ.

1.5 ADA AUDIBLE/VISUAL SYSTEMS

- A. Refer to the Architectural plans and provide an ADA type system for all areas of rescue as required by ADA. Not all areas may be defined as such.

1.6 SUBMITTALS

- A. Provide list of all types of equipment and components provided.
- B. Provide description of operation of the system, similar to that provided in Part 2 of this section, to include any and all exceptions, variances, or substitutions listed at the time of bid.

1.7 WARRANTY

- A. The equipment manufacturer shall guarantee the system equipment to the Owner for a period of one year from the date of final acceptance of the system.
- B. The Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one year from the date of final acceptance of the system.

1.8 ACCESS CONTROL SYSTEMS.

- A. Where there is any sort of door access system this contractor shall provide a relay and connection to directly interrupt power to the locks (as per NFPA).

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. As shown on Drawings (all systems shall have spare capacity in the control panel).
- B. All lines exiting the building shall have surge suppression.
- C. **All cable shall be plenum rated.**

2.2 ACCEPTABLE VENDORS

- A. The acceptable vendors are:
 - 1. AlarmTec Systems
 - 2. Encore Technology Solutions
 - 3. Reliable Fire Protection
- B. Other vendors may submit for approval 10 days prior to bid. Provide a minimum of eight references and information to verify the other requirements of this specification. If accepted the Engineer will put the newly accepted vendor in an addendum approving them for this project. **Vendors not listed here or in an addendum are not permitted.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install entire system in accordance with approved manufacturer's wiring diagrams. Furnish all conduit, wiring, outlet boxes, junction boxes, cabinets, and similar devices necessary for the complete installation. All wiring shall be of the type and size recommended by the manufacturer and shall be approved by the local fire department. Install wiring in dedicated conduit throughout.
- B. Install outside horns flush and weatherproof.
- C. Install smoke detectors in all mechanical closets and a duct detector in the supply plenum (and a firestat in the return) **of all** HVAC units (supply and return smoke detectors if over 15000 CFM) - see Mechanical Drawings for ratings.
- D. Install pull stations at each exterior door and exits from floors and no further than 200' apart.
- E. Install horn with strobe in each corridor, stairwell and as shown on Drawings and install strobes in public toilets. Strobe location shall comply with ADA.
- F. Provide connection to elevator recall controls.
- G. Extend phone lines to the main phone board for connection to the phone system. Provide all required fire alarm components for this connection.
- H. Install smoke detector at FAP whether indicated on the plans or not.
- I. Kitchen fire suppression systems shall be connected to the fire alarm panel whether indicated on the drawings or not. In addition provide connection to building automation system.
- J. Install smoke detectors on either side of doors that are equipped with door hold open devices whether indicated on the drawings or not.
- K. Refer to mechanical drawings and provide duct mounted smoke detectors at all smoke dampers and the appropriate controls. Make all required power and control connections.

3.2 TESTS

- A. Each individual system operation, on an address by address and circuit by circuit basis, shall be tested for its complete operation. Procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Engineer, and the manufacturer.

3.3 DOCUMENTATION AND TRAINING

- A. The Contractor shall compile and provide to the Owner four complete manuals on the finished system. Each manual shall include operating and maintenance instructions, catalog cuts of all equipment and components, all as-built wiring diagrams (both floor plan and riser types) and a manufacturer's spare parts list.
- B. In addition to the above manuals, the Contractor shall provide the service of a trained manufacturer's employee for not less than a four hour session, during normal business hours, to instruct the Owner's designated personnel on the operation and maintenance of the entire system.

END OF SECTION

**A NEW BRANCH OFFICE FOR
FIRST COMMUNITY BANK
GREENSBORO VILLAGE
JONESBORO, AR**

Civil Specifications

December 7, 2022

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The Civil Engineer of Record for
A NEW BRANCH OFFICE FOR
FIRST COMMUNITY BANK
GREENSBORO VILLAGE
In Jonesboro, AR is:



Date 12/07/22

SECTION 31 00 00

SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
- B. Section Includes
 - 1. Demolition of structures, paving, and utilities.
 - 2. Filling voids created as a result of removals or demolition.
- C. Related Sections
 - 1. Section 311000 - Site Clearing
 - 2. Section 312000 - Earthwork

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and runoff control.
- B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct public or private roadways, sidewalks, or fire hydrants without appropriate permits or written authorization.
- E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.
- F. Test soils around buried tanks for contamination.

1.3 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition. Submit record as part of closeout submittals.

1.4 PROJECT CONDITIONS

- A. Structures to be demolished will be discontinued in use and vacated prior to start of work.
- B. Owner assumes no responsibility for condition of structures to be demolished.
- C. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical. Variations within structures may occur by Owner's removal and salvage operations prior to start of demolition work.

- D. Unless otherwise indicated in Contract Documents or specified by the Owner, items of salvageable value to Contractor shall be removed from site and structures. Storage or sale of removed items on site will not be permitted without consent of the Owner and shall not interfere with other work specified.
- E. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to persons or for damage to property due to blasting operations. Performance of required blasting shall comply with governing regulations.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Fill material shall be aggregate fill materials as specified in Section 312000.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.
- B. Protect existing landscaping materials, appurtenances, and structures, which are not to be demolished. Repair damage to existing items to remain caused by demolition operations.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.
- D. Mark location of utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.
- E. Notify adjacent property owners of work that may affect their property, potential noise, utility outages, or other disruptions. Obtain written permission from adjacent property owners when demolition equipment

3.2 GENERAL DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures or pavements to remain.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed by authority.
- C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.
- D. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.
- E. Comply with governing regulations pertaining to environmental protection.
- F. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

- A. Demolish site improvements designated to be removed as shown on the drawings. Site improvements shall include but not be limited to structures, retaining walls, foundations, pavements, curbs and gutters, drainage structures, utilities, signage or landscaping.
- B. Disconnect and cap or remove utilities to be abandoned as shown on the drawings.
- C. Fill or remove underground tanks, piping, and appurtenances as shown.
- D. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to Owner and authorities having jurisdiction.
- E. Locate demolition equipment and remove materials to prevent excessive loading to supporting walls, floors, or framing.
- F. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2-feet or more below proposed subgrade to permit moisture drainage. Remove slabs-on-grade and below grade construction within 2-feet of proposed subgrade.

3.4 FILLING BASEMENTS AND VOIDS

- A. Completely fill below grade areas and voids resulting from demolition or removal of structures, underground fuel storage tanks, wells, cisterns, etc., using aggregate fill materials consisting of stone, gravel, or sand free from debris, trash, frozen materials, roots, and other organic matter.
- B. Areas to be filled shall be free of standing water, frost, frozen or unsuitable material, trash, and debris prior to fill placement.
- C. Place fill materials in accordance with Section 02300 unless subsequent excavation for new work is required.
- D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from site debris, rubbish, and other materials resulting from demolition operations. Leave areas of work in clean condition.
- B. No burning of any material, debris, or trash on-site or off-site will be allowed except when allowed by appropriate governing authority and Owner. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out and have been completely extinguished.
- C. Transport materials removed from demolished structures with appropriate vehicles and dispose off-site to areas that are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Cleaning site of debris, grass, trees, and other plant life in preparation for site or building earthwork.
 - 2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.
- B. Related Sections
 - 1. Section 310000 - Site Demolition
 - 2. Section 312000 - Earthwork

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by the "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.
- B. In event that sitework on this project will disturb 1 or more acres; Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.
- C. Contractor shall conduct storm water management practices in accordance with NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.3 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.

3.2 PROTECTION

- A. Locate, identify, and protect existing utilities that are to remain.
- B. Protect trees, plant growth, and features designated to remain as part of final landscaping.
- C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.
- E. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.3 EQUIPMENT

- A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, overloading, or pumping.

3.4 CLEARING

- A. Clear areas required for access to site and execution of work.
- B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 312000.
- C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.
- D. Cut heavy growths of grass from areas before stripping and topsoil removal and remove cuttings with remainder of cleared vegetative material.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation, filling, and backfilling for structures and pavement.
 - 2. Trenching and backfilling for utilities.
 - 3. Dewatering.
 - 4. Boring under crossings.
- B. Related Sections
 - 1. Section 312800 - Erosion Control and Sedimentation
- C. Order of Precedence: Geotechnical Engineering Report specifies requirements for earthwork preparation and placement of fill. The foundation design and site grading recommendations shall take precedence over the provisions of this section whenever duplication or conflict occurs.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 5. ASTM D 422 - Standard Test Method For Particle Size Analysis of Soil
 - 6. ASTM D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 7. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 8. ASTM D 2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
 - 9. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO T 88 - Particle Size Analysis of Soils
- C. State Department of Transportation (DOT):
 - 1. Standard Specifications for Construction and Materials
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code
- E. American Water Works Association (AWWA)
 - 1. AWWA C200 - Standard For Steel Water Pipe - 6 In. (150 Mm) And Larger
 - 2. AWWA C206 - Field Welding Of Steel Water Pipe

1.3 QUALITY ASSURANCE

- A. An independent testing laboratory, selected and paid for by the Contractor, will be retained to perform construction testing on site.

1. The independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Civil Engineering Consultant, and Owner shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the independent testing laboratory shall notify Owner and Contractor immediately.
2. Costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to Owner. Contractor shall provide free access to site for testing activities.
3. Quality assurance testing will be conducted in accordance with Paragraph "Field Testing" in Part 3 hereinafter.

1.4 DEFINITIONS

- A. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings. Satisfactory soil shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory including materials classified in ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.
 2. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

1.5 SUBMITTALS

- A. Submit 30-pound sample of each type of off-site fill material that is to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.
- B. Submit certification that all material obtained from off-site sources complies with specification requirements.
- C. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.
- D. If fabrics or geogrids are to be used, design shall be submitted for approval to Owner.
- E. Submit Dewatering Plans upon request by Owner.
- F. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.
- G. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

H. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill. Satisfactory soil materials excavated from the site.

B. Imported Fill Material: Satisfactory borrow material provided from offsite borrow areas when sufficient satisfactory soil materials are not available from required excavations.

C. Trench Backfill: ASTM D 2321 unless otherwise specified or shown on the drawings.

D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03300 or 03312 as applicable.

E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

H. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 12-inches. Topsoil shall be as further defined in Section 329300 – Planting.

I. Filter and drainage fabrics: As specified in Section 312800.

J. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.

K. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, which ever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:

3. Natural Gas or Propane - Yellow
4. Electric - Red
5. Telephone – Orange
6. Water – Blue
7. Sanitary Sewer – Green

2.3 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.4 SOURCE QUALITY CONTROL

A. Laboratory testing of materials proposed for use in the project shall be by the Independent Testing Laboratory at no cost to Owner. The Contractor shall provide samples of material obtained off-site.

B. In areas to receive pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) tests shall be performed for each type of material that is imported from off-site. CBR or LBR value shall be equal to or above pavement design subgrade CBR or LBR value indicated on Construction Drawings

C. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:

1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T 88 or ASTM D422.
3. Plasticity Index: ASTM D 4318

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.

B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Remove from site, material encountered in grading operations that, in opinion of Owner or the Contractor's Independent Testing Laboratory (ITL) is unsuitable or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in manner satisfactory to Owner. Backfill areas with layers of suitable material and compact as specified herein.

F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
2. After drainage of low area is complete, remove muck, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by the ITL. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of

site filling operation, but not under building subgrade or within 8'-0" of perimeter of building subgrade or paving subgrade. If, after observation by the ITL, material is found to be unsuitable, unsuitable material shall be removed from site.

- G. Locate and identify utilities that have previously been installed and protect from damage.
- H. Locate and identify existing utilities that are to remain and protect from damage.
- I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on The Drawings.
- J. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on The Drawings.
- K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted.

3.2 DEWATERING

A. General:

1. Provide dewatering systems as required for excavations.
2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.
3. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
4. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
5. Confine discharge piping or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits or easement.
6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
9. Install wells or wellpoints, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.

10. Control grading around excavations to prevent surface water from flowing into excavation areas.

11. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Design:

1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:

1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove subgrade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:

1. Dewatering shall be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.
4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

- B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.
- C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on The Drawings.

3.4 GENERAL EXCAVATION

- A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.
- B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.
- C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.
- D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building subgrades.
- E. Place suitable excavated material into project fill areas.
- F. Include an Undercut Allowance in the project. Stipulated cubic yards (CY) quantity to be provided by the Geotechnical Engineer. The Undercut Allowance is to include provisions for the removal, replacement and compaction of unsuitable soil. Provide unit pricing for actual quantity adjustment. Refer to Bid Form Supplements, Appendix A – Unit Prices, for schedule.
- G. Unsuitable excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.
- H. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.5 TRENCHING EXCAVATION FOR UTILITIES

- A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace overexcavation with suitable and dispose of unsuitable material.
- B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

- C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not required or not suitable for backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 02220.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.
- F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.
- I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
 - 1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
 - 2. Sanitary Sewer: Elevations and grades as indicated on the drawings and as specified in Section 02535.
 - 3. Storm Sewer: Elevations and grades as indicated on the Drawings.
 - 4. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
 - 5. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
 - 6. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
 - 7. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

3.6 SUBGRADE PREPARATION

- A. Scarification and Compaction: Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.
- B. Proofrolling: Subgrades shall be proofrolled to detect areas of insufficient compaction. Proofrolling shall be accomplished by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while

under the supervision and direction of the independent testing laboratory. Document and explain proofrolling inspection procedures and results in the laboratory inspection report. Areas of failure shall be excavated and recompacted as specified herein. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner. Subgrade exposed longer than 48 hours or on which precipitation has occurred shall be re-proofrolled.

3.7 FILLING

- A. Fill areas to contours and elevations shown on the Drawings with unfrozen materials.
- B. Place fills in continuous lifts specified herein.
- C. Fill within proposed building subgrade and paving subgrade shall not contain rock or stone greater than 6 inches in any dimension.
- D. Unless otherwise specified for rock fill, rock or stone less than 6-inches in largest dimension may be used in fill below structures, paving, and graded areas, up to 24 inches below surface of proposed subgrade or finish grade of graded areas when mixed with suitable material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed subgrade or finish grade of graded areas when mixed with suitable material.
- E. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.
- F. Material imported from off-site shall have CBR or LBR value equal to or above pavement design subgrade CBR or LBR value indicated on The Drawings.
- G. Building area subgrade pad shall be that portion of site directly beneath and 10 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.
- H. Prepare building area subgrade pad in strict accordance with the Geotechnical Engineering Report.
- I. Unless specifically stated otherwise in foundation design and site grading recommendations, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable materials to be used as fill in specified areas:

<u>Location</u>	<u>PI</u>	<u>LL</u>
Building area	20	45
Paving area	45	20

3.8 TRENCH BACKFILLING

- A. Materials used for trench backfill shall comply with requirements as specified herein.
- B. Backfill and compact in accordance with fill and compaction requirements in accordance with ASTM D 2321 unless otherwise shown on the drawings.
- C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.

- D. Backfill trenches to contours and elevations shown on the Drawings.
- E. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.9 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

- A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.
- B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 98 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T 180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.
- C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.
- D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.
- E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.
- F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.
- G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.10 COMPACTION

- A. Compact as follows:

<u>Location</u>	<u>Percent of Maximum Laboratory Density</u>	
	<u>ASTM D698</u>	<u>ASTM D1557</u>
Subgrade & Fill Below Structures	95	95
Subgrade & Fill Below Pavement	95	92

- B. Maintain moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.
- C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner.

3.11 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.
- C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified on the drawings. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.
- D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.12 BORROW AND SPOIL SITES

- A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.13 FINISH GRADING

- A. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.
- B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sodding, and seeding requirements refer to Section 329300.
- C. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

3.14 FIELD TESTING

- A. Field density tests for in-place materials will be performed by the Contractor's Independent Testing Laboratory (ITL) as follows:
 - 1. Building Subgrade Areas, Including 8'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.

2. Areas of Construction Exclusive of Building Subgrade Areas: In cut areas, not less than 1 compaction test for every 10,000 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
 3. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
 4. Test Method: In-place nuclear density, ASTM D 2922 (Method B-Direct Transmission).
- B. Corrective Measures For Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner. Adjust moisture content as necessary to conform to the requirements of this section.
- C. Field testing, frequency, and methods may vary as determined by and between the Contractor and the ITL.

END OF SECTION

SECTION 31 22 00

EXCAVATION, BACKFILL, AND COMPACTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.
- B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.
- C. Compacting for materials in acceptable manner as specified herein.

1.2 RELATED SECTIONS

- A. Section 312000 - Earthwork
- B. Section 312600 - Aggregate Material
- C. Construction drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition
 - 1. D422 Standard Test Method For Particle – Size Analysis of Soil
 - 2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - 5. D 2487 Classification of Soils for Engineering Purposes
 - 6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
 - 7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 - 8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
 - 1. T 88 Particle Size Analysis of Soils
 - 2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

- A. An independent testing laboratory, selected and paid by Contractor, will be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 312000 and as specified herein.
- B. Testing shall be in accordance with Part 3, "Field Quality Control".

1.5 SUBMITTALS

- A. Shop drawings or details pertaining to excavating and filling for structures are not required unless otherwise shown on Construction Drawings or if contrary procedures to Contract Documents are proposed.
- B. Submit 30-pound sample of each type of material from off-site borrow sources that is to be used in backfilling in air-tight container(s) to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill material from on-site as specified in Section 312000 and approved by Owner.
- B. Fill material from off-site as specified in Section 312000 and approved by Owner.
- C. Aggregate material as specified in Section 312600.

2.2 EQUIPMENT

- A. Transport off-site materials to the project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify lines, elevations, and grades necessary to construct building subgrades as shown on Construction Drawings.
- B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- C. Locate and identify utilities that have previously been installed and protect from damage.
- D. Locate and identify existing utilities that are to remain and protect from damage.
- E. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed structures. Stabilize these areas by using acceptable geotextile fabrics or aggregate materials placed and compacted as specified.

3.2 EXCAVATION

- A. Excavate building areas to line and grade as shown on Construction Drawings being careful not to over excavate beyond elevations needed for building subgrades unless otherwise required by the Contract Documents.
- B. Place suitable excavated material into project fill areas as specified in Section 312000.
- C. Unsuitable excavated material is to be disposed of in manner and location that is acceptable to Owner and local governing agencies.
- D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

- A. Building area subgrade pad shall be that portion of site directly beneath and 8-feet beyond building and appurtenances, including limits of future building expansion areas as shown on Construction Drawings.
- B. Prepare building area subgrade pad in strict accordance with the Geotechnical Engineering Report. Rocks larger than 6-in. shall not be part of building subgrade fill.
- C. Areas exposed by excavation or stripping and on which building subgrade preparations are to be performed shall be scarified to a minimum depth of 8-inches and compacted to minimum of 98 percent of maximum density, in accordance with ASTM D 698, (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Proofroll these areas to detect areas of insufficient compaction. Accomplish proofrolling by making a minimum of 2 complete passes with a fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under supervision and direction of the independent testing laboratory. Excavate and recompact areas of failure as specified herein. Continual failure areas shall be stabilized at no additional cost to Owner.
- D. Place fill materials used in preparation of subgrade in lifts or layers not to exceed 8-inches loose measure and compacted to at least 95 percent Standard Proctor in accordance with ASTM D 698 at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Unless specifically stated otherwise in The Geotechnical Engineering Report or Construction Drawings, following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable materials to be used as fill in specified areas:

<u>Location</u>	<u>PI</u>	<u>LL</u>
Building area	20	45

3.4 COMPACTION

- A. Maintain optimum moisture content of fill materials as specified above to attain required compaction density.
- B. Test materials in accordance with Section 312000.

- C. Corrective measures for non-complying compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.
- C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than that specified for fill herein. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.
- D. Construct temporary ditches and/or perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.6 FINISH GRADING

- A. Finish grading shall be in accordance with Section 312000 and as specified herein.
- B. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerance of 0.10-foot will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

3.7 FIELD QUALITY CONTROL

- A. See Section 312000, "Field Testing".

END OF SECTION

SECTION 31 23 00

EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavation of trenches for installation of utilities.
- B. Backfilling trenches with bedding material as specified and filling trenches with suitable material to proposed subgrade.
- C. Compacting backfill materials in acceptable manner.
- D. Borings and casings under roads.

1.2 RELATED SECTIONS

- A. Section 310000 - Site Demolition
- B. Section 312000 - Earthwork
- C. Section 334100 - Storm Drainage
- D. Section 312600 - Aggregate Materials
- E. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition
 - 1. D422 Standard Test Method For Particle – Size Analysis of Soil
 - 2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - 5. D 2487 Classification of Soils for Engineering Purposes
 - 6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
 - 7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 - 8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
 - 1. T 88 Particle Size Analysis of Soils
 - 2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

- A. An independent testing laboratory will perform testing at intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill and furnish copies of results as specified herein.
- B. Testing shall be in accordance with Part 3, "Field Quality Control".

1.5 SUBMITTALS

- A. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to Construction Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.
- B. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.
- C. Submit 30-pound sample of each type of fill material from off-site borrow sources that is to be used in backfilling, in air-tight container(s), to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of subsurface utilities, structures, and obstructions installed or encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Material: Aggregate Type as indicated on the plans and as specified in Section 312600.
- B. Haunching Material: As specified in Section 312600. Aggregate Type as indicated on the plans and as specified in Section 312600.
- C. Backfill material from the site as specified in Section 312000 and approved by Owner.
- D. Backfill material from off-site as specified in Section 312000 and approved by Owner.
- E. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on Construction Drawings.
- F. Backfill material shall not contain rock or stone with a maximum size greater than 2 inches.

2.2 LOCATOR TAPE

- A. Locator tape shall be heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the

tape at one-half the minimum depth of cover for the utility line or a maximum of 3', whichever is the lesser, but never above the top of subgrade. Color of tape shall be determined by APWA Color Standards: Natural Gas- Yellow, Electric - Red, Telephone – Orange, Water – Blue, Sanitary Sewer – Green.

2.3 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Set lines, elevations, and grades for proposed systems.
- B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- C. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on Construction Drawings.
- D. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on Construction Drawings.
- E. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or additional bedding material placed and compacted.
- F. Provide dewatering systems as required for utility excavations. Dewatering systems shall comply with requirements of Section 312000.

3.2 EXCAVATION

- A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.
- B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25-feet in trenches 4-feet or deeper.

- C. Perform excavation as indicated on Construction Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not required or not suitable for backfill or embankments and waste off site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 310000.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified in Section 312000.
- F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. For pipes 12 inches in diameter or smaller, total trench width below top of pipe shall be the outside diameter plus not less than 12 inches nor more than 18 inches with the pipe or conduit that is to be installed to designated elevations and grades centered in the trench. For pipe diameters greater than 12 inches, trench width below the top of pipe shall be wide enough to accommodate workmen and equipment but not less than 18 inches. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.
- I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
 - 1. Water Mains: 30-inches to top of pipe barrel or 6-inches below frost line, established by local building official, whichever is deeper.
 - 2. Sanitary Sewer: Elevations and grades as indicated on Construction Drawings.
 - 3. Storm Sewer: Elevations and grades as indicated on Construction Drawings.
 - 4. Electrical Conduits: 24-inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
 - 5. TV Conduits: 18-inches minimum to top of conduit or as required by local utility company, whichever is deeper.
 - 6. Telephone Conduits: 18-inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
 - 7. Gas Mains and Service: 30-inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

3.3 PIPE BEDDING

- A. Accurately cut trenches for pipe or conduit that is to be installed to designated elevations, 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel.

3.4 BACKFILLING

- A. Criteria: Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified in Sections 312000 and one or more of the following sections, as applicable: 312200 for trenches below structures or 312400 for trenches below pavements. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified herein, to properly correct the condition in an acceptable manner.
- B. Backfilling: After pipe or conduit has been installed, bedded, and tested as required, backfill trench or structure excavation with specified material placed as given in the Construction Documents.
- C. Backfill trenches to contours and elevations shown on Construction Drawings with unfrozen materials.
- D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.5 COMPACTION

- A. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.
- B. Maintain optimum moisture content of fill materials as specified in Section 312000 to attain required compaction density.
- C. Materials used for backfill shall comply with requirements of Section 312600 and as specified herein.

3.6 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

- A. When indicated by Construction Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.
- B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T 180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.
- C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.
- D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks at no additional

cost to Owner. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area at no additional cost to Owner.

- E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt in accordance with area specifications and governing authorities.
- F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206 and AWS D7-0-62.
- G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.7 FIELD QUALITY CONTROL

See Section 312000, "Field Quality Control".

END OF SECTION

SECTION 31 24 00

EXCAVATION, BACKFILL, AND COMPACTION FOR PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.
- B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.
- C. Compacting fill materials in acceptable manner as specified herein.

1.2 RELATED SECTIONS

- A. Section 312000 - Earthwork
- B. Section 321206 - Base Course
- C. Section 312600 - Aggregate Materials
- D. Section 321216 - Asphaltic Concrete Paving
- E. Section 321333 - Curbs and Sidewalks
- F. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition
 - 1. D422 Standard Test Method For Particle – Size Analysis of Soil
 - 2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - 5. D 2487 Classification of Soils for Engineering Purposes
 - 6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
 - 7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 - 8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
 - 1. T 88 Particle Size Analysis of Soils
 - 2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.4 QUALITY ASSURANCE

- A. Independent Testing Laboratory, selected and paid by Contractor, will be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 02300 and as specified herein.
- B. Testing shall be in accordance with Part 3, Section 3.07, "Field Quality Control".

1.5 SUBMITTALS

- A. Shop drawings or details pertaining to excavating and filling for pavement are not required unless otherwise required by the Construction Documents or if contrary procedures to Construction Documents are proposed.
- B. Submit 30-pound sample of each type of off-site fill material that is to be used in backfilling in air-tight container to independent testing laboratory or submit gradation and certification of aggregate material that is to be used to independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill material from on-site as specified in Section 312000 and approved by Owner.
- B. Fill material from off-site as specified in Section 312000 and approved by Owner.
- C. Aggregate material as indicated on the plans and as specified in Section 312600.

2.2 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify lines, elevations, and grades necessary to construct pavements, curb, curb and gutter, bases, sidewalk, and roadways as shown on Construction Drawings.
- B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- C. Locate and identify site utilities that have previously been installed and protect from damage.
- D. Locate and identify existing utilities that are to remain and protect from damage.

- E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted.

3.2 EXCAVATION

- A. Excavate roadway and pavement areas to line and grade as shown on Construction Drawings.
- B. Place suitable material into project fill areas as specified in Section 02300.
- C. Unsuitable excavated material is to be disposed of in manner and location that is acceptable to Owner and local governing agencies.
- D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

- A. Areas exposed by excavation or stripping and on which subgrade preparations for paving are to be performed, including future pavement areas, shall be scarified to minimum depth of 8-inches and compacted to not less than 95 percent of maximum density, in accordance with ASTM D 698 (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content. Proofroll these areas to detect areas of insufficient compaction. Accomplish proofrolling by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum loaded weight of 20 tons, or approved equal, in each of 2 perpendicular directions until acceptable. Excavate and recompact areas of failure as specified herein. Continual failure areas shall be stabilized at no additional cost to Owner.

- B. Place fill materials used in preparation of the subgrade in lifts or layers not to exceed 8-inches loose measure and compacted to minimum density of not less than 95 percent of maximum density, in accordance with ASTM D 698, (or 95 percent of maximum density, in accordance with ASTM D 1557) at moisture content of not less than 2 percent below and not more than 3 percent above optimum moisture content.

- C. Following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used in specified areas, unless specifically stated otherwise on Construction Drawings:

	<u>PI</u>	<u>LL</u>
Paving Area	20	45

- D. Fill material imported from off-site or fill material removed from onsite cut areas shall have CBR or LBR value equal to or greater than pavement design subgrade CBR or LBR value indicated on Construction Drawings.

3.4 COMPACTION

- A. Maintain optimum moisture content of fill materials as specified herein to attain required compaction density.

- B. Test materials in accordance with Section 312000.
- C. Corrective measures for non-complying compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.
- D. Construct temporary ditches and/or perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.5 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction including concrete trucks, dump trucks, and other construction equipment.
- C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

- A. Finish grading shall be in accordance with Section 312000 and as specified herein.
- B. Check grading of paving areas by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerances of 0.10-foot, more or less, will be permitted. Contractor is to provide engineering and field staking necessary for verification of lines, grades, and elevations.

3.7 FIELD QUALITY CONTROL

- A. See Section 312000, "Field Quality Control".

END OF SECTION

SECTION 31 26 00

AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aggregate materials for use as specified in other Sections.

1.2 RELATED SECTIONS

- A. Section 310000 – Site Demolition
- B. Section 311000 – Site Clearing
- C. Section 312000 – Earthwork
- D. Section 312200 – Excavation, Backfill, and Compaction for Structures
- E. Section 312300 – Excavation, Backfill, and Compaction for Utilities
- F. Section 312400 – Excavation, Backfill, and Compaction for Pavement
- G. Section 312800 – Erosion Control and Sedimentation
- H. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition
 - 1. C136 Method for Sieve Analysis of Fine and Coarse Aggregates
 - 2. D698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 3. D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 4. D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - 5. D2487 Classification of Soils for Engineering Purposes
 - 6. D2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
 - 7. D3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 - 8. D4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
 - 1. T 88 Particle Size Analysis of Soils
- C. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition.

1.4 QUALITY ASSURANCE

- A. Tests and analysis of aggregate materials will be performed in accordance with ASTM and AASHTO procedures specified herein.

1.5 SUBMITTALS

- A. Submit 30-pound sample of each aggregate or mixture that is to be incorporated into project in air-tight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be incorporated into project to the independent testing laboratory for review.
- B. Submit name of each material supplier and specific type and source of each material. Any change in source requires approval of Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Construction and materials shall meet or exceed requirements of this Section and applicable state highway department specifications section(s) referred to or noted on the Construction Drawings which pertain to paving base course design, materials, preparation, and execution. Materials shall be as indicated in the Construction Documents and shall comply with state highway department specifications regarding source, quality, gradation, soundness, absorption, liquid limit, plasticity index, and mix proportioning.
- B. Soil Materials
 - 1. Class II: Coarse-Grained Soils; conforming to ASTM D2487 Group Symbol, GW, GP, SW and SP.
 - 2. Class III: Coarse-Grained Soils with Fines; conforming to ASTM D2487 Symbol GM, GC, SM and SC.
 - 3. Class IV-A: Fine-Grained Soils (inorganic); conforming to ASTM D2487 Group Symbol ML and CL.
 - 4. Class IV-B: Fine Grained Soils (inorganic); conforming to ASTM D2487 Group Symbol MH and CH.
 - 5. Class V: Organic Soils; conforming to ASTM D2487 Group Symbol OL, OH, and PT.
- C. Aggregate Material
 - 1. Coarse Aggregate Type A1: Material shall be sound crushed limestone, crushed slag, granulated slag, crushed gravel, or other types of suitable material meeting the requirements of this section. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

Sieve Size	Percent Passing
1 1/2 inches	100
1 inch	75-100
3/4 inch	60-100
3/8 inch	35-75
No. 4	30-60
No. 30	7-30
No. 200	0-5

2. Coarse Aggregate Type A2: Material shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slag, or other types of suitable material meeting the requirements of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

Sieve Size	Percent Passing
2 inches	100
1 inch	70-100
3/4 inch	50-90
No. 4	30-60
No. 30	7-30
No. 200	0-5

3. Aggregate Type A3: Pea Gravel – Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM C136 and D2487; to the following limits:

- a. Minimum size: 1/4 inch
- b. Maximum Size: 5/8 inch

4. Fine Aggregate Type A4: Sand – Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136 and D2487; within the following limits:

Sieve Size	Percent Passing
No. 4	90-100
No. 50	7-40
No. 200	0-5

5. Class I-A: Material shall be sound crushed limestone, crushed slag, granulated slag, crushed gravel, or other types of suitable material meeting the requirements of this item. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

Sieve Size	Percent Passing
1-1/2 inches	100
No. 4	≤ 10
No. 200	< 5

6. Class I-B: Material shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slag, or other types of suitable material meeting the requirements of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

Sieve Size	Percent Passing
1-1/2 inches	100
No. 4	≤ 50
No. 200	< 5

2.2 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger any improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 STOCKPILING

- A. Stockpile on-site at locations indicated by Owner in such manner that there will be no standing water or mixing with other materials.

3.2 BORROW AND SPOIL SITES

- A. Upon completion of borrow and/or spoil operations, clean up borrow and/or spoil areas as indicated on Construction Drawings in neat and reasonable manner to satisfaction of property owner and Owner.

END OF SECTION

SECTION 31 28 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Installation of temporary and permanent erosion and sedimentation control systems.
 - 2. Installation of temporary and permanent slope protection systems.
- B. Related Sections
 - 1. Section 311000 - Site Clearing
 - 2. Section 312000 - Earthwork
 - 3. Storm Water Pollution Prevention Plan
 - 4. Construction Drawings ("Site Maps")

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Protect adjacent properties, any identified endangered or threatened species or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Seed, sod, and ground covers for the establishment of vegetation.
- B. Sediment control devices as specified on the Construction Drawings.
- C. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.
- D. Temporary mulches such as loose, straw, wood cellulose, or agricultural silage.
- E. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Review the drawings and Storm Water Pollution Prevention Plan.
- B. Revise SWPPP as necessary to address potential pollution from site identified after issuance of the SWPPP at no additional cost to owner.
- C. Conduct storm water pre-construction meeting with Site Contractor, all ground-disturbing Sub-contractors, site engineer of record or someone from their office familiar with the site and SWPPP, and state or local agency personnel in accordance with requirements of the special conditions.

3.2 EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Place erosion and sediment control systems in accordance with the drawings and Storm Water pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.
- B. Deficiencies or changes on the drawings or Storm Water Pollution Prevention Plan shall be corrected or implemented as site conditions change. Changes during construction shall be noted in the Storm Water Pollution Prevention Plan and posted on the drawings (Site Maps).
- C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.
- D. Maintain temporary erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours if required at no additional cost to the Owner.
- E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.
- F. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.
- G. Unless required within a shorter timeframe by the applicable General Permit for Storm Water Discharges Associated with Construction Activity, slopes that erode easily or that will not be graded for a period of 14 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Soil treatment for termite control at the new building. Includes applying toxicant to designated soil, re-treating during warranty period when subsequent active termite infestation is detected.

1.2 REFERENCES

- A. Environmental Protection Agency:
 - 1. EPA FIFRA - Federal Insecticide, Fungicide and Rodenticide Act.
- B. National Pest Management Association:
 - 1. NPMA WDO - Wood Destroying Organism Library.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal procedures.
- B. Product Data: Submit toxicants to be used, composition by percentage, dilution schedule, intended application rate. Include product label information.
- C. Test Reports: Indicate regulatory agency approval reports.
- D. Manufacturer's Application Instructions: Indicate caution requirements and in accordance with current product label of chosen pesticide.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Record moisture content of soil before application, date and rate of application, areas of application, and diary of toxicity meter readings and corresponding soil coverage.
- C. Operation and Maintenance Data: Indicate re-treatment schedule.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 5 years documented experience.
- B. Applicator: Company specializing in performing the Work of this section with minimum 10 years documented experience, approved by manufacturer and licensed at Project location.

1.6 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year warranty.
- C. Warranty: Include coverage for damage and repairs to building and building contents caused by termites. Repair damage. Re-treat where required.
- D. Inspect and report annually to Owner in writing.
- E. Owner has option of extending damage guarantee contract at an annual fee mutually agreed upon by the Owner and the applicator. Owner reserves the right to cancel as of any anniversary date.
- F. The contract is non-cancellable by the applicator.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Toxicant Chemical: Local authority approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.

2.2 MIXES

- A. Mix toxicant to manufacturer's instructions, to a uniform consistency.
- B. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- C. Verify final grading and excavation are complete.
- D. Apply toxicant just prior to installation of vapor barrier under slabs-on-grade in accordance with product label supplemented by the NPCA's ARP for termiticiding or local requirements.

3.2 APPLICATION

- A. Apply toxicant at Project building site, before footings and slabs are placed.
- B. Apply extra treatment to structure penetration surfaces including pipe or ducts, and soil penetrations including grounding rods or posts.
- C. Re-treat disturbed treated soil with same toxicant as original treatment.
- D. When inspection or testing identifies presence of termites, re-treat soil and re-test.

3.3 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished Work.
- B. Do not permit soil grading over treated work.
- C. Re-treat disturbed treated soil with same toxicant as original treatment.

END OF SECTION

SECTION 32 12 06

BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Aggregate base for asphaltic concrete and Portland cement concrete paving including sand/shell base and hot-mix sand asphalt base.
- B. Related Sections
 - 1. Section 312000 – Earthwork

1.2 REFERENCES

- A. Asphalt Institute
- B. State Highway Department Standard Specifications

1.3 QUALITY ASSURANCE

- A. An independent testing laboratory, selected and paid by Contractor, will be retained to perform construction testing of in-place base course for compliance with requirements for thickness, compaction, density, and tolerances. Paving base course tolerances shall be verified by rod and level readings on not more than 50-foot centers to be not more than 0.05-feet above design elevation which will allow for paving thickness as shown on Construction Drawings. Contractor shall provide instruments and suitable benchmark.

1.4 SUBMITTALS

- A. Submit materials certificate to the independent testing laboratory that is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.
- B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

1.5 WEATHER LIMITATIONS

- A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIAL

- A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed slag, stone, or gravel, etc), sand/shell base material, or a hot-mix sand asphalt base.

- B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.
- C. Aggregate base material requirements from State or other local highway agency specifications may be use for aggregate base course for roads, streets, or similar use pavements if the following conditions are met:
 - 1. Percentage of material by weight passing the No. 200 sieve will not exceed 10.
 - 2. Portion of the material passing the No. 40 sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.
- D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, angular sand, or other approved material. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
 - 1. Coarse aggregates shall be angular particles of uniform density.
 - 2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.
- E. Gradation: The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 inches and shall be continuously well graded within the following limits:

GRADATION OF AGGREGATES
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	----	----
1-1/2 inch	70-100	100	----
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

NOTE: Particles having diameters less than 0.0008 inch shall not be in excess of 3 percent by weight of the total sample tested.

- F. Hot-mix Sand Asphalt Bases: Asphalt Institute Type VI, VII, or VIII Mixes for Hot-mix Sand Asphalt Bases. Hot-Mix base shall be used only under asphaltic concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02300.

3.2 CONSTRUCTION

- A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.
- B. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.
- C. Compact base material to not less than 95 percent of optimum density, as determined by ASTM D 698 unless otherwise indicated on the Drawings.
- D. Construct to thickness indicated on Construction Drawings.
 - 1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.
 - 2. Sand/Shell Base: Apply in lifts or layers not exceeding 4-inches, measured loose.
 - 3. Hot-mix Sand Asphalt Bases: Apply in lifts or layers not exceeding 3-inches, measured loose.

3.3 FIELD QUALITY CONTROL

- A. Field testing specified below will be performed by the Contractor's Independent Testing Laboratory at no cost to the Owner.
- B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Contractor's Testing Laboratory.
- C. Field density tests for in-place materials will be performed in accordance with the following:
 - 1. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
 - 2. Base material thickness: One test for each 20,000 sq. ft. of in-place base material area.
 - 3. Base material compaction: One test in each lift for each 20,000 sq. ft. of in-place base material area.
- D. The independent testing laboratory will prepare reports that indicate test location, elevation data, and test results. Owner and Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications; Owner and Contractor will be notified immediately by the independent testing laboratory.
- E. The Contractor shall certify in writing to the Owner that base course placement is in accordance with specification requirements prior to subsequent work thereon.
- F. The Contractor shall pay for retesting due to failures at no additional expense to Owner. Contractor shall provide free access to the site for testing activities.

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

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 WORK INCLUDED

- A. Prepare subgrade to receive base course.
- B. Provide compacted base course.
- C. Place base course and place asphaltic concrete hot mix (ACHM) binder course.
- D. Tack base course and place ACHM surface course.

1.3 RELATED WORK

- A. Section 312000 - Earthwork
- B. Section 334100 - Storm Drainage
- C. Section 321333 - Concrete Curb and Gutters
- D. Section 033000 - Cast in Place Concrete

1.4 REFERENCES

- A. Arkansas State Highway and Transportation Dept. (AHTD):
 - 1. Standard Specifications for Highway Construction, Edition of 2003, hereafter referred to as "AHTD Standard Specifications".

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIALS

- A. Crushed Stone: Class 7, meeting the requirements of section 303 of the AHTD Standard Specifications, or approved equal.
- B. Tack Coat: Shall be applied as specified and meeting the requirements of section 401 of the AHTD Standard Specifications.

2.2 ASPHALT PAVEMENT MATERIALS

A. ACHM Surface Course:

1. Type 2 mix as described in Sections 407 and 409 of the AHTD Standard Specifications.
2. The surface course shall be composed of a mixture of mineral aggregate and asphalt cement in the proportions by weight for the type mixture designated.

B. ACHM Binder Course:

1. Type 2 mix as described in Sections 405 and 409 of the AHTD Standard Specifications.
2. The base course shall be composed of a mixture of mineral aggregate and asphalt cement in the proportions by weight for the type mixture designated.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Ensure grading of the subgrade to the required elevation.
- B. Scarify to a depth of six inches the subgrade where the base course is to be placed.
- C. Water and thoroughly mix subgrade until optimum moisture content is obtained when deficiency of moisture content exists. When excess of moisture exists, rework and aerate subgrade until optimum moisture content is obtained.
- D. Re-compact the subgrade to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the Drawings.
- E. Before final rolling, shape the entire area to the required cross section, adding additional subsoil as required and compact the subgrade surface to the required density.

3.2 PLACEMENT OF BASE COURSE

- A. Place the crushed stone base material over the prepared subgrade in accordance with the construction methods described in section 303 of the AHTD Standard Specifications.
- B. Place the crushed stone base material over the prepared building pad at 4 inches in depth. The building slab will be placed over the compacted base material.
- C. Add water during compaction to bring the base course materials to optimum moisture content. When an excess moisture exists, rework the base course materials until optimum moisture content is obtained.
- D. Compact the base course to not less than 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the Drawings.

3.3 PLACING TACK COATS

- A. Apply the bituminous tack coat to the prepared base at the rate of 0.03 gallon to 0.10 gallon per square yard as designated by the Architect/ Engineer.
- B. Clean the base course surface and place the tack coats in accordance with the requirements of section 401 of the AHTD Standard Specifications.

3.4 PLACING ACHM SURFACE COURSE

- A. Construction Methods: Section 410, AHTD Standard Specifications.
- B. Temperature range of mix:
 - 1. When discharged from mixer: 285 degrees F. to 325 degrees F.
 - 2. When placed on base course: 275 degrees F. 325 degrees F.
- C. Temperature of air: Do not place ACHM when air temperature in the shade is below 40 degrees F.
- D. Place asphalt pavement to compacted depth shown on Drawing.
- E. Compact to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue displacement.
- F. Required density: 92 percent of maximum theoretical density.
- G. Carry out compaction in three operations in pass sequence. Ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material.
- H. Perform hand tamping in areas not accessible to rolling equipment.
- I. Ensure joints made during paving operations and at connection to existing pavement are straight, clean vertical and free of broken or loose material.
- J. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding 1/4 inch when measured with a 10 foot straight-edge.
- K. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

3.5 FIELD QUALITY CONTROL

- A. Testing laboratory will make in-place tests of density and moisture content of the subgrade and the base course in accordance with ASTM D 2922-78.
- B. Testing laboratory will make density tests of compacted asphalt paving in accordance with ASTM D 107-76.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Preparation and placement of Portland cement concrete parking areas.
2. Preparation and placement of Portland cement concrete roads and entrances.

1.3 Related Sections

1. Section 312000 - Earthwork
2. Section 321206 - Base Course
3. Section 321313 - Pavement Markings

1.4 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 301 -Structural Concrete for Buildings.
2. ACI 305R - Hot Weather Concreting
3. ACI 306R - Standard Specification for Cold Weather Concreting
4. ACI 308 - Standard Practice for Curing Concrete

B. American Society for Testing and Materials (ASTM)

1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
3. ASTM C 31 - Test Methods of Making and Curing Concrete Test Specimens in the Field.
4. ASTM C33 - Concrete Aggregates
5. ASTM C 39 - Test Method for Comprehensive Strength of Cylindrical Concrete Specimens.
6. ASTM C42 - Obtaining And Testing Drilled Cores And Sawed Beams Of Concrete
7. ASTM C94 - Ready-Mixed Concrete
8. ASTM C 138 - Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
9. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
10. ASTM C150 - Portland Cement
11. ASTM C 172 - Method of Sampling Freshly Mixed Concrete.
12. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C260 - Air-Entraining Admixtures for Concrete
14. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
15. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
16. ASTM C1064 - Temperature Of Freshly Mixed Portland Concrete Cement
17. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
18. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
19. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

C. Federal Specifications (FS)

1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

D. State Highway Department Standard Specifications

1.5 QUALITY ASSURANCE

- A. Establish and maintain required lines and elevations.
- B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

1.6 SUBMITTALS

- A. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Engineering Consultant of Record and the Independent Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.
 - 1. Portland cement concrete mix
 - 2. Aggregate gradations
 - 3. Preformed expansion joint filler
 - 4. Field molded/poured sealant
 - 5. Dowel bars
 - 6. Expansion sleeves
 - 7. Tie bars
 - 8. Reinforcing steel bars
 - 9. Welded wire fabric
 - 10. Air entraining admixtures
 - 11. Water-reducing and set-retarding admixtures (if used)
- B. Submit certification that joint sealant has been installed in accordance with the manufacturer's instructions. Include copy of written instructions.

1.7 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete: Mix concrete and deliver in accordance with ASTM C94.
 - 1. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - a. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
 - b. Slump Range: 1"-3" for hand placed concrete, 1-1/4" to 3" for machine placed (slipform) concrete
 - c. Air Entrainment: 5 to 7 percent
- B. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

- C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.
- D. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.
- E. Portland Cement: ASTM C150, Type I
- F. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D994, D1751, D2628; FS HH-F-341, Type II, Class A.
- G. Joint Sealants: ASTM C920, non-priming, pourable, self-leveling polyurethane.
 - 1. Acceptable sealants include Sonneborn "SL1", Sonneborn "SL2", Sonneborn "Sonomeric 1", Sonneborn "Sonomeric 2", Mameco "Vulkem 245", or Woodmont Products "Chem-Caulk".
- H. Aggregate: ASTM C33.
- I. Water: Clean and potable
- J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.
- K. Air Entraining Mixture: ASTM C260, Sika AER by Sika Corporation or Air Mix by the Euclid Chemical Corporation.
- L. Curing Compound: ASTM C309, Hydrocide by Sonneborn of Rexnord Chemical Products, Inc. or Polyseal 4 in 1 by Chem Masters Corporation.
- M. Joint Backup Rods: CCEVA Rod 100 by E-Poxy Industrials, Inc., or Sealtight BACKER ROPE by W.R. Meadows, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proofroll prepared base material surface to check for unstable areas in accordance with Section 312000 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

- A. Form Construction
 - 1. Set forms to required grades and lines, rigidly braced and secured.
 - 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
 - 3. Check completed formwork for grade and alignment to following tolerances:
 - a. Top of forms not more than 1/8-inch in 10'-0".
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
 - 4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

- B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.
- C. Concrete Placement
 - 1. Concrete may be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.
 - 2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
 - 3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - 4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint.
- D. Joint Construction: Construct expansion, weakened-plane control (contraction), and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
 - 1. Weakened-Plane Control or Contraction Joints: Provide joints at spacing of 15'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
 - a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
 - b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
 - 2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints in accordance with standard details.
 - 3. Transverse Expansion Joints: Locate expansion joints at maximum of 180'-0" on centers, maximum each way unless otherwise shown on the Construction Drawings. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.
 - 4. Butt Joints: For joints against existing pavement, place 16" long dowels eight inches into holes drilled into center of existing slab. Epoxy dowels into holes with approved epoxy compound. Place dowels prior to concrete placement for new concrete. Dowel spacing to be 24" on center unless otherwise shown on Construction Drawings. Saw joint and fill with joint sealer.
- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.
- F. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide continuous smooth finish.
- B. Work edges of slabs and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
 - 1. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
 - 2. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.
- D. Protect and cure finished concrete paving using either membrane curing compound or moist-curing methods described in "water-curing" section of ACI 308.

3.4 CLEANING AND ADJUSTING

- A. The Contractor shall certify in writing that placement is in accordance with specification requirements.
- B. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.5 FIELD QUALITY CONTROL

- A. Field quality control tests specified herein will be conducted by the Contractor's Independent Testing Laboratory at no cost to the Owner in accordance with Section 01458. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor's expense.
- B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Contractor's Testing Laboratory.
- C. Review the Contractor's proposed materials and mix design for conformance with specifications.
- D. Perform testing in accordance with ACI 301 and testing standards listed herein.
- E. Strength Tests:
 - 1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
 - 2. Mold and cure specimens in accordance with ASTM C 31.

- a. A minimum of four concrete test cylinders shall be taken for every 100 cubic yards or less of each class of concrete placed each day and not less than once for each 5000 square feet of paved area.
 - b. During the initial 24 hours (plus or minus 8 hours) after molding, the temperature immediately adjacent to the specimens shall be maintained in the range of 60 to 80 degrees F. Control loss of moisture from the specimens by shielding from the direct rays of the sun and from radiant heating devices.
 - c. Specimens transported prior to 48 hours after molding shall not be demolded, but shall continue initial curing at 60 to 80 degrees F until time for transporting.
 - d. Specimens transported after 48 hours age shall be demolded in 24 hours (plus or minus 8 hours). Curing shall then be continued but in saturated limewater at 73.4 degrees (plus or minus 3 degrees F) until the time of transporting.
 - e. Wet cure cylinders under controlled temperature until testing.
 - 3. Test cylinders in accordance with ASTM C 39.
 - a. Date test cylinders and number consecutively. Give each cylinder of each set an identifying letter (i.e. A, B, C, D). Prepare a sketch of the building plan for each test set identifying location of placed concrete.
 - b. Test one cylinder (A) at 7 days for information. If the compressive strength of the concrete sample is equal to or above the 28 day specified strength, test another cylinder (B) at 7 days. The average of the breaks shall constitute the compressive strength of the concrete sample.
 - c. Test two cylinders (B and C) at 28 days and the average of the breaks shall constitute the compressive strength of the concrete sample.
 - d. Retain fourth cylinder (D) for further testing if needed, but do not retain cylinder more than 60 days.
 - 4. Evaluation and Acceptance:
 - a. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength test (average of two cylinders) results are below specified compressive strength by more than 500 psi.
 - b. Complete concrete work will not be accepted unless requirements of ACI 301, have been met, including dimensional tolerances, appearance, and strength of structure.
 - c. Where average strength of cylinders, as shown by tests is not satisfactory, Owner reserves the right to require Contractor to provide improved curing conditions of temperature and moisture to secure required strength. If average strength of laboratory control cylinders should fall so low as to cause portions of structure to be in question by Owner, follow core procedure set forth in ASTM C42. If results of core test indicate, in opinion of Owner, that strength of structure is inadequate, provide without additional cost to Owner, replacement, load testing, or strengthening as may be ordered by Owner. If core tests are so ordered and results of such tests disclose that strength of structure is as required, cost of test will be paid by Owner.
- F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143. Make additional slump tests for every other load from a stationary mixer or truck to test consistency. Sampling shall be in accordance with ASTM C 172.
- G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138. Indicate test method on report. Make test at same time as slump test.
- H. Unit Weight: ASTM C 138.

- I. Temperature Test: Conduct temperature test for each cylinder set taken in accordance with ASTM C 1064. Test hourly when air temperature is 40 F and below or 80 F and above. Determine temperature of concrete sample and ambient air for each strength test.
- J. In addition to required information noted previously in this Section, record the following information on concrete compression reports:
 - 1. Test cylinder number and letter.
 - 2. Specific foundations or structures covered by this test.
 - 3. Proportions of concrete mix or mix identification.
 - 4. Maximum size coarse aggregate.
 - 5. Specified compressive strength.
 - 6. Tested compressive strength.
 - 7. Slump, air-content (when applicable) and concrete temperature.
 - 8. Concrete plastic unit weight.
 - 9. Concrete Temperature.
 - 10. Elapsed time from batching at plant to discharge from delivery truck at project.
 - 11. Date and time concrete was placed.
 - 12. Ambient temperature, wind speed, and relative humidity during concrete placement.
 - 13. Name of technician securing samples.
 - 14. Curing conditions for concrete strength test specimens (field and laboratory).
 - 15. Date strength specimens transported to laboratory.
 - 16. Age of strength specimens when tested.
 - 17. Type of fracture during test.
- K. At the start of each day's mixing, report any significant deviations from approved mix design including temperature, moisture and condition of aggregate.
- L. Certify each delivery ticket of concrete. Report type of concrete delivered, amount of water added and time at which cement and aggregate were loaded into truck, and time at which concrete was discharged from truck
- M. In Place Pavement Testing: The Contractor's Independent Testing Laboratory will randomly core pavement at minimum rate of 1 core per 20,000 sq. ft of pavement, with minimum of 3 cores from heavy-duty areas and 3 cores from light duty areas. Cores will be sampled and tested in accordance with ASTM C 42. Core will be tested for thickness and quality of aggregate distribution. Core holes shall be patched by the Contractor immediately with Portland cement concrete and shall be finished to provide level surface as specified herein.
- N. Additional Tests: Additional in-place tests shall be conducted as directed by the Owner when specified concrete strengths and other characteristics have not been attained in the structures.

END OF SECTION

SECTION 32 13 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Painting and marking of pavements, curbs, guard posts, and light pole bases.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation (AASHTO)

1. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints

B. American Society for Testing and Materials (ASTM)

1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.

C. Federal Specifications (FS)

1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I)
2. FS TT-P-1952 - Paint, Traffic And Airfield Marking, Waterborne

1.4 PROJECT CONDITIONS

- ###### A.
- Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

1.4 QUALITY ASSURANCE

- ###### B.
- Use trained and experienced personnel in applying the products and operating the equipment required for properly performed work.

PART 2 - PRODUCTS

2.1 MATERIALS

- ###### A.
- Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.
- ###### B.
- Waterborne Paint: Paints shall conform to FS TT-P-1952.
- ###### C.
- Solvent Borne Paint: Paint shall conform to FS A-A-2883 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be mixed in accordance with manufacture's instructions before application for colors White, Yellow, Blue, and Red.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.
- C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 CLEANING EXISTING PAVEMENT MARKINGS

- A. In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or do not interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.4 APPLICATION

- A. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.
- B. Install pavement markings according to manufacturer's recommended procedures for the specified material.
- C. Following items shall be painted with colors noted below:
 - 1. Pedestrian Crosswalks: White
 - 2. Exterior Sidewalk Curbs, Light Pole Bases, and Guard posts: Yellow
 - 3. Fire Lanes: Red or per local code
 - 4. Lane Striping where separating traffic moving in opposite directions: Yellow
 - 5. Lane Striping where separating traffic moving in the same direction: White
 - 6. ADA Symbols: Blue or per local code
 - 7. ADA parking space markings as shown on the drawings.
 - 8. Parking Stall Striping: Yellow, unless otherwise noted on Construction Drawings

3.5 FIELD QUALITY CONTROL

- A. Inspection: After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.
- B. Testing: Testing of wet film thickness shall be performed a minimum of two times on each parking row (including striped islands) and pedestrian cross walks, and a minimum of one test on each lane/alignment striping. At least one test shall be performed after refilling paint striping machine, changing operators of striping machine, and changing paint types, brands, etc. This shall be performed in addition to the testing stated above. These tests shall be performed on each coat applied. Testing shall be performed in accordance with ASTM D4414.

3.6 CLEANING

- A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION

SECTION 32 13 33

CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Portland cement concrete curb, gutter, and sidewalk.
- B. Related Sections
 - 1. Section 312000 - Earthwork

1.2 REFERENCES

- A. American Concrete Institute (ACI)
 - 1. ACI 305R - Hot Weather Concreting
 - 2. ACI 306R - Standard Specification for Cold Weather Concreting
 - 3. ACI 308 - Standard Practice for Curing Concrete
- B. American Standards for Testing and Materials (ASTM) latest edition
 - 1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
 - 3. ASTM C94 - Ready-Mixed Concrete
 - 4. ASTM C260 - Air-Entraining Admixtures for Concrete
 - 5. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
 - 6. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
 - 7. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type
 - 8. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 - 9. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- C. Federal Specifications (FS)
 - 1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)
- D. State Highway Department Standard Specifications

1.3 SUBMITTALS

- A. Submit materials certificate from materials producer and Contractor, certifying that materials comply with, or exceed requirements specified herein to the Engineering Consultant of Record and the Independent Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed, submit for approval, certified laboratory test data or manufacturers certificates and data for the following items:
 - 1. Portland cement concrete mix
 - 2. Aggregate gradations
 - 3. Preformed expansion joint filler
 - 4. Field molded/poured sealant
 - 5. Dowel bars
 - 6. Expansion sleeves
 - 7. Tie bars

8. Reinforcing steel bars
9. Welded wire fabric
10. Air entraining admixtures
11. Water-reducing and set-retarding admixtures (if used)

1.4 QUALITY ASSURANCE

- A. Establish and maintain required lines and elevations.
- B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.5 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete: Mix concrete and deliver in accordance with ASTM C94.
 1. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - a. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
 - b. Slump Range: 1"-3" for hand placed concrete, 1-1/4" to 3" for machine placed (slipform) concrete
 - c. Air Entrainment: 5 to 7 percent
- B. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.
- C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets.
- D. Reinforcing Steel: Deformed steel bars, ASTM A 615, Grade 60.
- E. Portland Cement: Shall conform to ASTM C150, Type I
- F. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D994, D1751, D2628; FS HH-F-341, Type II, Class A or approved equal.
- G. Joint Sealants: Conforming to ASTM D1190, non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 245", or Woodmont Products "Chem-Caulk".
- H. Aggregate: ASTM C33.

- I. Water: Clean and potable
- J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.
- K. Air Entraining Mixture: ASTM C260; Sika AER by Sika Corporation or Air Mix by the Euclid Chemical Corporation.
- L. Curing Compound: ASTM C309; Hydrocide by Sonneborn of Rexnord Chemical Products, Inc. or and Polyseal 4 in 1 by Chem Masters Corporation.
- M. Joint Backup Rods: CCEVA Rod 100 by E-Poxy Industrials, Inc., Sealtight BACKER ROPE by W.R. Meadows, Inc. or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

- A. Form Construction
 - 1. Set forms to required grades and lines, rigidly braced and secured.
 - 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
 - 3. Check completed formwork for grade and alignment to following tolerances:
 - a. Top of forms not more than 1/8-inch in 10'-0".
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
 - 4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.
- C. Concrete Placement
 - 1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.
 - 2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.
 - 3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - 4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine

may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

D. Joint Construction

1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold it's shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with 1/2-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

- F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
- B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
1. Curbs, gutters, and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.
- D. Protect and cure finished concrete paving using acceptable moist-curing methods in accordance with "water-curing" section of ACI 308.

3.4 BACKFILL

- A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 312000.

3.5 CLEANING AND PROTECTION

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

SECTION 32 13 43

PERVIOUS CONCRETE PAVEMENT

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Exterior pervious concrete pavement for use as parking area pavement
- B. Related Sections
 - 1. Section 321313 - Portland Cement Concrete Pavement

1.2 PERFORMANCE

- A. General: Performance testing shall be conducted on laboratory and field specimens.
- B. Strength: Average compressive strength shall be 2,500 psi minimum. Strength values shall be determined according to ASTM C 39/C 39M and as specified herein.
- C. Pavement Thickness: Hardened pervious concrete pavement shall be of uniform thickness with no section less than the specified pavement thickness minus 1/4-inch.
- D. Void Content: Void content shall be 15-25% as determined in accordance with ASTM C 138.
- E. Percolation: Percolation rate shall be 1.5 inches per minute minimum, as determined by the falling head permeameter, in accordance with ASTM D 5084.
- F. Unit weight: Unit weight shall be $\pm$ five (5) pcf of the design unit weight. Unit weight shall be determined according to ASTM C 140.
- G. Durability: Hardened pervious concrete pavement shall be resistant to raveling during the first year of use. Excessive raveling shall be as determined by the Engineer.

1.3 DEFINITIONS

- A. Cold Weather: A period when for more than three successive days the average daily outdoor temperature drops below 40 °F (5 °C). The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50 °F (10 °C) occur during more than half of any 24 h duration, the period shall no longer be regarded as cold weather.
- B. Hot Weather: Any combination of the following conditions that tend to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise resulting in detrimental results. Hot weather conditions include:
 - 1. high ambient temperature;

2. high concrete temperature;
3. low relative humidity;
4. wind velocity; and
5. solar radiation.

- C. Panel: An individual concrete slab bordered by joints or slab edges.
- D. Pervious Concrete Pavement: Concrete pavement intended to allow for the infiltration of surface runoff. Typically pervious concrete pavement is defined as having a minimum of 15% void space. Typical applications include roadways, sidewalks, canals, drainage ways, playgrounds, and parking surfaces.
- E. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast—furnace slag.
- F. AHTD Standard Specification: “Standard Specifications for Highway Construction,” Edition of 2003, published by the Arkansas State Highway and Transportation Department.
- G. NRMCA — National Ready Mixed Concrete Association.
- H. ACI — American Concrete Institute.
- I. ASTM — American Society of Testing Materials.

1.4 SUBMITTALS

- A. Submit information in accordance with Section 013300 — Submittals.
- B. Provide a minimum of three (3) design mixtures proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 2. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 3. From the three (3) design mixtures submitted for review, two (2) shall be selected to be utilized in the construction of test panels.
- C. Provide qualification data for suppliers, installers, and the testing agency.
- D. Provide material certificates signed by the manufacturer certifying that each of the following materials complies with all specification requirements:
 1. Cementitious materials.
 2. Admixtures. Manufacturer shall certify that all proposed admixtures are compatible with each other and contribute no water soluble chloride ions exceeding those permitted in hardened concrete.
 3. Curing compounds/evaporation retardants.

- E. Provide detailed information for construction equipment including compaction equipment, cross roller screed and joint roller. Compaction equipment data shall include photos, manufacturers cut sheets or shop fabrication drawings. Provide any additional information for equipment requested by the Engineer. Provide field quality-control test reports at intervals specified herein to the Contractor, Engineer and Owner.

Provide a minimum of two (2) test panels per selected design mixture, or as required by the Engineer. Each test panel shall be a minimum of 225 square feet in size. Thickness shall as required by the proposed pervious concrete pavement section. Provide testing of test panels as specified. Test panels shall be constructed until at least one (1) design mixture has satisfied all the requirements of this specification and any additional requirements of the Engineer. The Contractor shall revise design mixtures and construct test panels at no cost to the Owner.

1. Test panels shall be placed at the pervious concrete pavement manufacturer's batching facility. Batching of design mixtures and construction of test panels shall be open to observation by the Engineer and Owner.
2. Test panels shall have four (4) total core samples taken from each panel in accordance with ASTM C 42 to be utilized for testing. Two (2) core samples shall be obtained after a minimum of seven (7) days of curing and an additional two (2) samples shall be obtained after a minimum of twenty eight (28) days of curing after placement of the pervious concrete. The cores shall be tested for;
 - a. Pavement thickness: Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than 1/4 inch less than the specified thickness.
 - b. Void structure: in accordance with ASTM C 138
 - c. Unit weight. After thickness determination, the cores shall be trimmed and measured for unit weight in the saturated condition as described in Paragraph 6.3.1 "Saturation" of ASTM C 140, Standard Methods of Sampling and Testing Concrete Masonry Units. The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. The range of satisfactory unit weight values are $\pm$ five (5) pcf of the design unit weight.
3. Satisfactory performance of the test panels will be determined by:
 - a. Compacted thickness no less than 1/4" of specified thickness.
 - b. Void Content :t three (3) percent of the design void content.
 - c. Unit weight :t five (5) pcf of the design unit weight.

- F. Joint Layout Shop Drawings: Joint drawings that detail and layout plan for construction, expansion, and contraction joints.

- G. Field Specimens: Provide a detailed plan for construction of field specimens. Include both construction and removal of specimens from field panels.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment. Contractor shall provide evidence

of manufacturer's employment of one NRMCA Certified Pervious Technician who has received hand-on training in the construction of pervious concrete pavements. Certified Technician shall witness all batch mixing of pervious concrete pavement material.

B. Installer Qualifications: A qualified installer who employs on Project, personnel qualified as NRMCA — Pervious Concrete Technicians. Contractor shall provide evidence of employment of two (2) NRMCA Certified Pervious Technicians who have received hand-on training in the construction of pervious concrete pavements and who must be on-site working as members of each placement crew during all concrete placement.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548. The testing agency shall also be certified by the AHTD.

1. Personnel conducting field tests shall be qualified as NRMCA Certified Pervious Concrete Technician and AC1 Concrete Field Testing Technician, Grade 1, according to AC1 CP-01 or an equivalent certification program. They shall also be certified by the AHTD.

D. ACI Publications: Comply with the following ACI publications, most recent revision, unless modified by requirements in the Contract Documents.

1. AC1 301, Specification for Structural Concrete.
2. AC1 305.1, Standard Specification for Hot-Weather Concreting.
3. AC1 306.1, Standard Specification for Cold-Weather Concreting.
4. AC1 308.1, Standard Specification for Curing Concrete.
5. AC1 522.1 R, Pervious Concrete.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for normal plant operation and other construction activities.

B. Site Selection: Site pervious concrete pavement such that cross slopes are minimized. Cross slopes of less than 1% are desirable. Maximum cross slope of pervious concrete pavements shall be five percent (5%).

C. Subgrade: Subgrades shall be protected and evaluated for permeability/infiltration capacity.

1. Subgrades shall be protect from over compaction during excavation and construction of pervious concrete pavement. Subgrades that experience over compaction, as defined by the Engineer, shall be scarified and/or removed to a depth determined by the Engineer.

2. Soils that are impermeable or can be classified as clay according to ASTM standards shall require a sub-drainage system designed to dewater subgrades completely within 72 hours of a 2-inch, 24-hour rainfall event.

3. Engineered backfill materials shall not be allowed for use as fill/embankment.

D. Edge Treatment: Pervious concrete pavement that is adjacent to roadway pavements, landscaped or grassed areas, or other concrete pavement shall be constructed with the following edge treatment.

1. Roadway pavements: A reinforced concrete curtain wall shall be constructed between pervious concrete pavements and adjacent roadways. Curtain wall shall be continuous from the finished pavement surface to a point 6— inches below the bottom of subgrade of the deeper section (pervious pavement vs. roadway pavement).

2. Landscaped/grassed areas: A grout rub shall be applied to the edge of pervious concrete pavements that are adjacent to any granular material including landscaped and grassed areas. The grout rub shall be 'A-inch thick and seal the pavement from infiltration of soil particles.

3. Concrete: A tooled joint shall be constructed at all edges of pervious concrete pavement that are adjacent to concrete sidewalks, slabs or roadway pavements. The joint shall be sealed.

PART 2 - PRODUCTS

2.1 DRAINAGE SUB-BASE

A. General: A drainage sub-base course shall be constructed under all pervious concrete pavements. The drainage sub-base course shall be designed to detain the 2-year 24-hour rainfall volume for the project area. Design of the drainage sub-base course shall consider the infiltration capacity of the subgrade soils. If subgrade soils are determined to be clay, or impervious a subdrainage system shall be constructed to allow the drainage sub-base course to drain.

- B. Materials: AHTD #57 or #67 stone. Double washed.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

1. Portland Cement: ASTM C150, Type I or III. Supplement with the following:
 - a. Fly Ash: ASTM C618 Class C. A maximum of 25% of the cementitious material by weight may be allowed, as approved by the Engineer.
2. Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - a. Fly Ash: 25 percent.
 - b. Combined Fly Ash and Pozzolan: 25 percent.

B. Coarse Aggregates: ASTM C33 #8 Class crushed limestone coarse aggregate. Provide coarse aggregate that meets definitions in AHTD-502-C, unless specified otherwise. Provide aggregate from single source with documented service record of at least 10 years' satisfactory service in similar application and service conditions using similar aggregate and cementitious materials.

1. Maximum Coarse Aggregate Size: 3/8 inch nominal.

C. Fine Aggregates: ASTM C33 Class fine aggregate, coarse sand.

D. Water: ASTM C 94/C 94M and potable.

1. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.3 ADMIXTURES

A. General

1. Provide written certification from the manufacturer for each admixture product proposed, noting compliance with all applicable standards, specifically standards referenced herein.
2. Provide written certification from the manufacturer that each admixture is compatible with all other proposed admixtures in the pervious concrete pavement design mixture.
3. Provide written certification from the manufacturer that each admixture does not contribute water-soluble chloride ions exceeding those permitted in hardened traditional concrete pavement.
4. Do not use calcium chloride or admixtures containing calcium chloride.
5. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as

- required, for placement and workability.
6. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 7. Use water-reducing admixture in concrete exposed to freeze/thaw or deicers.
- B. Air-Entraining Admixture: Conforming to the requirements of ASTM C 260, AASHTO M154 and CRD-C13.
1. Available Products:
 - a. BASF Admixture Systems/Master Builders; Micro-Air
 - b. Approved equal
- C. Water-Reducing Admixture: Conforming to the requirements of ASTM C494/C494M, Type A.
1. Available Products:
 - a. BASF Admixture Systems/Master Builders; Polyheed 900
 - b. Approved equal
- D. Retarding Admixture: Conforming to the requirements of ASTM C494/C494M, Type B.
- E. Water-Reducing and Retarding Admixture: Conforming to the requirements of ASTM C494/C494M, Type D.
- F. Viscosity-Modifying Admixture: Conforming to the requirements of ASTM C494/C494M, Type S.
1. Dosage proportions of viscosity-modifying admixtures shall be based on average temperature and humidity for the site during the time of year proposed for placement. If concrete placement will take place during more than one season, multiple design mixtures may be required.
 2. Available Products:
 - a. BASF Admixture Systems/Master Builders; Rheomac VMA 362
 - b. Approved equal
- G. Hydration-Stabilizer Admixture: Conforming to the requirements of ASTM C494/C494M Type B and Type D.
1. Dosage proportions of hydratin-stabilizing admixtures shall be based on average temperature and humidity for the site during the time of year proposed for placement. If concrete placement will take place during more than one season, multiple design mixtures may be required.
 2. Available Products:
 - a. BASF Admixture Systems/Master Builders; Delvo Stabilizer
 - b. Approved equal
- H. Reinforcing Fibers: Conforming to the requirements of ASTM C1116/CI 1 I6M
1. Reinforcing fibers shall be made of polypropylene.
 2. Available Products:
 - a. BASF Admixture Systems/Master Builders; MasterFiber F70
 - b. Approved equal

2.4 CONCRETE MIXTURES

- A. Pervious Concrete Pavement: Open-graded permeable concrete pavement mixture as follows:
1. Minimum Compressive Strength: 2,500 psi at 28 days.
 2. Water-Cementitious Materials Ratio: 0.30-0.32.
 3. Voids: 15-25% of in-place cured pervious concrete.

4. Unit Weight: Plus or minus 5% of theoretical unit weight as determined by mix design. (Typ. 100-125111/rr'.)
5. Reinforcing fibers shall be utilized in all design mixtures at a minimum rate of 3lbs/yd, unless approved by the Engineer.

2.5 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1 hour to 45 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 40 minutes.
 2. Keep records showing time and place of each pour (placement) of concrete, together with transit-mix delivery slips certifying the contents of the pour (placement). Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in the coarse aggregate. If water is added on the job, the total water content shall not exceed the water content of the approved design mix. Furnish records to Engineer upon request.

2.6 CURING MATERIALS

- A. Curing Compound/Evaporation Retardant: Curing compound shall not form a continuous impenetrable coating on the pavement surface, thus preventing rainfall infiltration.
 1. Available Products:
 - a. C2 Products Inc., Noblesville, Indiana; "The Bean"
- B. Vapor Cover: Clear polyethylene sheeting with a minimum thickness of 6 mil.
 1. Sheets shall be sufficiently sized to overlap edge forms and provide overlapping seams.
 2. Clear plastic sheeting shall be used in the summer and when conditions may cause excessive heat gain by the curing concrete.
 3. Black sheeting shall be used in the winter

2.7 EQUIPMENT

- A. Strike-Off Equipment: Aluminum screed of sufficient length to overhand each side of the formwork by a minimum of 18-inches. Screed shall be straight level, and true.
- B. Consolidation Equipment: Manual-operated steel compaction rollers.
 1. The primary compaction roller shall be of adequate width to ride on the forms and shall provide a minimum of 10 psi uniform vertical force across the pavement panel.
 2. The primary compaction roller shall be a minimum 10-inch diameter, 4-inch thick steel pipe.
 3. The ends of the primary compaction roller shall be closed and a means of filling the roller with water or other weight shall be provided.
 4. The primary compaction roller shall include handles on each end to allow for pulling the equipment over the pavement.
 5. Secondary compaction rollers shall be utilized to cross roll panels. Secondary compaction rollers shall be approximately 18-inch wide, 4-inches diameter and weigh a minimum of 100 lbs.
- C. Jointing Equipment: Joints shall be tooled with a joint roller of sufficient weight to cut the joint with no additional downward force exerted by the laborer. The joint roller shall feature a joint blade of sufficient length to cut a joint one-third the pavement thickness. Hand jointing tools

may be used to clean up joints.

- D. Edging Equipment: Edges shall be tooled to provide a downturned, chamfered edge of approximately 1/2 — inches.
- E. No bull floats are allowed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Excavate to the lines, grades and elevations as called for in the Plans. Rough grade to final subgrade elevations using minimal passes of equipment.
- B. Examine exposed subgrades and drainage subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- C. Examine underdrain systems for open-graded void structure. If void structure has been compromised, crushed stone underdrain bedding material shall be replaced prior to placement of pervious concrete pavement drainage subbase materials.
- D. Construct drainage course to the thickness required by the pervious concrete pavement section. Drainage course shall be properly consolidated. Additional consolidation shall be performed immediately prior to placement of concrete materials if deemed necessary by the Engineer. Remove deleterious material from subbase surface before placing concrete materials.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Forms may be made of wood, plastic, or steel and shall be the depth of the pavement.
- B. Forms shall be of sufficient strength and stability to support consolidation equipment. Sufficient bracing shall be provided to resist lateral movement. Forms shall be constructed to allow the compaction roller to be cleared from the pavement panel after placement of concrete materials to allow for protection and curing activities.
- C. All forms should be cleaned and oiled as necessary.
- D. Riser strips, 3/4 inch tall, shall be placed on top of pavement forms to allow for a smooth initial strike-off surface. The riser strips shall be removed immediately prior to vibratory consolidation of pervious concrete pavement.
- E. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work. Forms shall remain in place at least 24 hours after concrete placement.
- F. Clean forms after each use to ensure separation from concrete without damage.

3.3 PLACEMENT

- A. Pervious concrete shall be placed no later than one (1) hour after initial batch mixing. Use of retarding chemical admixture, as approved by the Engineer, shall allow for a half-hour extension to the maximum time between batch mixing and placement.

- B. No additional water shall be added to batch mix after placement has begun, unless approved by the Engineer.
- C. Moisten drainage subbase prior to placement.
- D. Rake pervious concrete pavement into place and level using a manual screed. Care shall be taken to minimize:
 - 1. pulling or shoveling of fresh concrete into final position;
 - 2. filling voids in the concrete;
 - 3. contaminating the pervious concrete with deleterious materials;
 - 4. walking in the pervious concrete.
- E. Evaporation retardant should be lightly sprayed on the surface following strike-off and prior to compaction.
- F. Concrete shall be screeded to 3/4 inch (19 mm) above forms to allow for consolidation. Consolidate pervious concrete with a hand-operated vibratory compaction steel roller to thickness shown on the Contract Drawings within 15 minutes of placement.
- G. Adjacent to sidewalks and at exposed pavement edges, the concrete shall be tooled to provide a smooth corner.
- H. After strike-off, compaction, and edging, no other finishing operations shall be performed.
- I. Prior to curing, if concrete has lost its "sheen," it shall be lightly misted.

3.4 JOINTS

- A. General: Form construction, expansion, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. Joints shall be spaced every 20 feet maximum.
 - 2. The larger dimension of a contiguously-placed pervious concrete pavement panel shall not exceed 125% of the smaller dimension.
 - 3. The minimum angle between two intersecting joints shall be 80° unless otherwise specified or permitted.
 - 4. Joints shall intersect pavement-free edges at 90° angles and shall extend straight for a minimum of 1- 1/2 feet (0.5 m) from the pavement edge, where possible.
 - 5. Align joints of adjacent panels.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
- C. Isolation and Expansion Joints: Form joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals as indicated on the Drawings.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - 4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 5. Protect top edge of joint filler during concrete placement with metal, plastic, or other

temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-third of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
 - 1. Joint Roller: Form contraction joints with joint roller tool. Construct 1/8 inch (3 mm) wide contraction joints into concrete a depth of one-quarter the thickness of the pavement immediately after consolidation.

3.5 PROTECTION AND CURING

A. General: Protect freshly placed pervious concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after jointing pervious concrete pavement.

C. Cure pervious pavement according to ACI 308.1:

- 1. Moisture-Retaining-Cover Curing: Cover pervious concrete pavement with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12-inches (300 mm), and sealed by water proof tape of adhesive.

Cure for not less than seven days for cement concrete mixtures, and 10 days for concrete mixtures that incorporate supplementary cementitious materials. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Cover shall be pulled and secured as tight as possible.
- b. No soil or granular material shall be used to secure the polyethylene cover.

3.6 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

- 1. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
- 2. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm).
- 3. Joint Spacing: 3 inches (75 mm).
- 4. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
- 5. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.7 FIELD QUALITY CONTROL

A. Testing and Construction Observation: Owner will provide a qualified testing agency to perform tests submit material data and observation reports. The Engineer shall provide observation services of construction activities. The Resident Project Representative (RPR) shall be the agent of the Engineer and Owner. The RPR shall, at a minimum:

- 1. Verify the use of required design mixture.
- 2. Observe concrete placement, including conveying, depositing, screeding, consolidation, curing and protection.
- 3. Verify maintenance of curing requirements throughout the curing period.
- 4. Note deviations from the specification for further discussion with the Engineer.

B. Concrete Tests:

- 1. Testing Frequency: Obtain one composite sample for each day's pour exceeding 5 cu. yd. but not less than 20 cu. yd. plus one set for each additional 40 cu. yd or fraction thereof.

- a. A composite sample shall include a minimum of four test specimens obtained according to ASTM C 172, a minimum of two test specimens obtained according to ASTM C 42/C 42M and a minimum of four test specimens obtained according to the requirements herein for preparation of field specimens.
 - 1) Field specimens shall be prepared using exactly the same construction methods utilized for placement of the pervious concrete pavement. The Contractor shall submit for review a plan for construction of field specimens.
 - b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements.
- a. Unit Weight: ASTM C 29; one test at point of placement for each composite sample, but not less than one test for each day's pour. Perform additional tests when concrete consistency appears to change. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cu. ft. cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 paragraph II, Jigging Procedure. On-site unit weights will be within 5% of the design unit weight.
 - b. Void Content: ASTM C 138; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - c. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27deg C) and above, and one test for each composite sample.
 - d. Compressive—Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two laboratory-cured specimens at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
3. Testing of composite samples of field-cured pervious concrete pavement obtained according to ASTM C 42/C 42M shall be performed according to the following requirements.
- a. Visual Observation: The Engineer shall visually observe all cores for verification of necessary void space to facilitate drainage.
 - b. Pavement Thickness: One test for each composite sample, but not less than one test for each day's pour. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than 1/4 inch less than the specified thickness.
 - c. Unit Weight: ASTM C 140; one test for each composite sample, but not less than one test for each day's pour. Cores shall be trimmed and measured for unit weight in the saturated condition as described in paragraph 6.3.1 "Saturation" of ASTM C 140. The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. Perform additional tests when concrete consistency appears to change. On-site unit weights will be within 5% of the design unit weight.
 - d. Void Content: ASTM C 138; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

- e. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27deg C) and above, and one test for each composite sample.
 - f. Compressive-Strength Tests: ASTM C 39/C 39M; test one field-cured specimen at 7 days and one field-cured specimen at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - g. Percolation Rate: One test for each composite sample, but not less than one test for each day's pour. The percolation rate of the pervious concrete pavement shall be as determined by the following head permeameter. Perform additional tests when concrete consistency appears to change. Percolation rate will be within .5 inches per minute of the design percolation rate.
4. Testing of composite samples of field specimens of pervious concrete pavement obtained according to these specifications shall be performed according to the following requirements.
- a. Visual Observation: The Engineer shall visually observe all cores for verification of necessary void space to facilitate drainage.
 - b. Unit Weight: ASTM C 140; one test for each composite sample, but not less than one test for each day's pour. Cores shall be trimmed and measured for unit weight in the saturated condition as described in paragraph 6.3.1 "Saturation" of ASTM C 140. The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. Perform additional tests when concrete consistency appears to change. On-site unit weights will be within 5% of the design unit weight.
 - c. Void Content: ASTM C 138; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - d. Compressive-Strength Tests: ASTM C 39/C 39M; test one field-cured specimen at 7 days and one field-cured specimen at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - e. Percolation Rate: One test for each composite sample, but not less than one test for each day's pour. The percolation rate of the pervious concrete pavement shall be as determined by the following head permeameter. Perform additional tests when concrete consistency appears to change. Percolation rate will be within .5 inches per minute of the design percolation rate.
5. Pervious concrete pavement thickness shall be measured at regular intervals at the cured edges of pervious concrete pavement panels.
6. Test results shall be reported in writing to Engineer, Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
7. Correct deficiencies in the Work that test reports and observations indicate do not comply with the Contract Documents.

3.8 REPAIRS AND PROTECTION

- A. Drill test cores, where directed by Engineer, when necessary to determine the magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with pervious cement pavement.
- B. Protect concrete from damage. Exclude traffic from pervious concrete pavement for at least 28 days after placement or as directed by the Engineer. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur. No vehicles with loose sedimentary material shall be allowed on pervious concrete pavement, ever. No materials shall be stored on the pervious concrete pavement.
- C. Storage of hazardous chemicals shall not be allowed on pervious concrete pavement.
- D. Stockpile or storage of any material that may clog voids of pervious concrete pavement shall not be allowed.
- E. Maintain pervious concrete pavement free of stains, discoloration, dirt, and other foreign material.
- F. Vacuum sweep pervious concrete pavement and power wash not more than two days before date scheduled for Substantial Completion walk through.

3.9 WARRANTY

- A. Contractor shall warranty pervious concrete pavements from defects in material and craftsmanship for a period of one (1) year from the date of final completion.
- B. Contractor shall repair or replace, at no cost to the Owner, any pavement panels found to be defective within the one (1) year warranty period.
- C. A defective panel shall be determined by the Engineer and shall be based on a failure of a minimum of three (3) of the performance criteria, as specified herein.

END OF SECTION

SECTION 32 83 00

SITE SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Traffic control signs.
 - 2. Site signs.

1.2 REFERENCES

- A. American Standard for Testing Materials (ASTM)
 - 1. ASTM C94 - Ready Mix Concrete
- B. US Department of Transportation, Federal Highway Administration
 - 1. Manual on Uniform Traffic Control Devices (MUTCD).

PART 2 - PRODUCTS

2.1 SIGNS: All signs will be furnished and installed by the Contractor. Conform to the following and MUTCD classification is shown in parentheses:

- A. "STOP" Signs: 30-inches x 30-inches, Octagon, white legend and border on red background (R1-1)
- B. "YIELD" Signs: 36-inches x 36-inches x 36-inches, Triangle, red legend and border band with white interior (R1-2)
- C. "SPEED LIMIT 10MPH" Signs: 12-inches x 18-inches, black legend and border on white background (R2-1)
- D. "NO RIGHT TURN" (or "NO LEFT TURN") Signs: 24-inches x 24-inches, black legend and border, red circle and bar, and white background (R3-1 and R3-2)
- E. "RIGHT TURN ONLY" (or "LEFT TURN ONLY") Signs: 30-inches x 36-inches, black legend and border on white background (R3-5)
- F. "DO NOT ENTER" Signs: 30-inches x 30-inches, white legend, bar, and background and red circle (R5-1)
- G. "NO TRUCKS" Signs: 24-inches x 24-inches, black truck symbol, red circle and bar, on white background (R5-2)
- H. "ACCESSIBLE PARKING SYMBOL" Signs: 18-inches x 24-inches, green legend and border, white symbol on blue box, and white background (R7-8)
- I. "PED XING" Signs: 30-inches x 30-inches, black legend and border on yellow background (W11-2)
- J. Miscellaneous Signs: See Construction Drawings

2.2 POSTS

- A. 2" diameter galvanized steel pipe with galvanized sign-mounting hardware for each sign.

2.3 CONCRETE

- A. Mix concrete and deliver in accordance with ASTM C94.
- B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - 1. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
 - 2. Slump Range: 1 to 3-inches at time of placement
 - 3. Air Entrainment: 5 to 8 percent

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contractor shall field verify underground utilities prior to sign installation. Primary utilities of concern of shallow depths are lawn sprinkler systems, electric, telephone, fiber optic, cable and gas.
- B. Cost related to repair of damaged surface and subsurface facilities shall be paid for by the Contractor at no additional expense to the Owner.

3.2 INSTALLATION

- A. Install posts in 12 inch diameter x 24 inch deep concrete foundations. Set posts vertical and plumb with bottom of sign at minimum 7'-0" above finish grade unless otherwise indicated on the Construction Drawings. Mount signs in accordance with manufacturer's instructions. Existing concrete shall be core-drilled as necessary.

END OF SECTION

SECTION 328400

LANDSCAPE IRRIGATION SYSTEM

PART 1-GENERAL

1.1 WORK INCLUDED

- A. Installation of automatic lawn and shrub sprinkler system providing uniform moisture coverage.
- B. Furnishing of materials and installation of a complete automatic lawn and shrub sprinkler system providing uniform moisture coverage. The work shall include all materials, equipment and labor required to complete the project as outlined in the project drawings, documents and this specification.
- C. Installation of backflow preventer, pressure regulator, irrigations lines (pressurized), automatic control valves, valve boxes, control and coming wiring, lateral lines, sprinkler heads, automatic controller as shown on the project drawings and irrigation plan.
- D. Excavation and Backfill.
- E. Tests including system pressure and performance test.
- F. Pipe and fittings.
- G. Sprinkler heads.
- H. Control system and connection to electrical supply.
- I. Trenching, installation of system and connection to water source; testing and backfilling.
- J. Sleeving.

- 1. Direct and coordinate with the General Contractor for desired sleeve locations and sizes. It is the responsibility of the Irrigation Contractor to do this otherwise the Irrigation Contractor is responsible for the irrigation sleeving.

1.2 RELATED WORK

- A. Section 329200 - Turf and Grasses
- B. Section 329300 – Planting

1.3 REFERENCES

- A. ANSI/ASTM D2564 – Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

- B. ASTM D2241 – Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- C. ASTM – American Society of Testing Materials
- D. AWWA – American Water Works Association
- E. NSF – National Sanitary Foundation
- F. NEC – National Electric Code

1.4 DESCRIPTION

- A. Electric solenoid controlled underground sprinkler system consisting of PVC plastic pipe and fittings, with fixed spray and variable arc rotary pop-up heads in a multi-station electric control system, programmed as approved by Owner.

1.5 SUBMITTALS

- A. Provide (3) copies of manufacturer's product data for each type of sprinkler head, swing joint assemblies, electric control valves, automatic and manual drain valves, isolation valves, valve boxes, pipe, fittings including tapping tees and saddles, control wire, waterproof wire connectors, irrigation controller, backflow preventer, booster pump and rain and freeze sensors proposed for use.
- B. Provide manufacturer's product data, each type of sprinkler head and valve proposed for use.
- C. Upon completion and final review of system by Owner, Contractor shall provide record or as-built drawings (reproducibles) of completed facilities as installed. Drawings shall be provided to contractor in a) electronic form (Autocad format) b) three (3) copies of the as-built drawing in or photocopy form and size. As-built drawings shall show the measured distance from easily identified, fixed locations to isolation valves, electric control valves, manual drain valves and wire splices.
- D. Upon completion and final review of system by Owner, Contractor shall provide three (3) binders containing manufacturer's installation, operation and maintenance instructions as well as a parts breakdown and catalog for each piece of equipment installed on the project. As a minimum the binders shall include information for the irrigation controller, booster pump, backflow preventer, pressure regulators, isolation valves, electric control valves, drain valves, air relief valves, all spray and rotary sprinkler heads, rain and freeze moisture sensors.
- E. Upon completion and final review of system by Owner, contractor shall provide a plastic laminated (sealed) reduced drawing of the irrigation system indicating the area or zones of the irrigation system controlled by each electric control valve. For clarity, drawing may be divided into two sections and shown on both sides of the laminated sheet. Reduced drawings shall be placed on the inside of the controller door. Drawing shall be approved for clarity by Contractor prior to acceptance of system.

1.6 OPERATION/MAINTENANCE DATA AND DEMONSTRATION

- A. Provide instructions for operation and maintenance of system and controls, and manufacturer's parts catalog.
- B. Provide schedule indicating length of time each valve is required to be open to provide determined amount of water.
- C. Provide a recommended schedule for run times and frequency of watering for the first two weeks, the first two months and the first twelve months (including all seasonal change requirements) after completion of the installation.

1.7 EXTRA STOCK

- A. Provide the following extra stock items:
 - 1. Two sprinkler heads of each type and size.
 - 2. Two valve keys for manual valves.
 - 3. Two keys for valve markers.
 - 4. Two wrenches for each type head core and for removing and installing each type head.
 - 5. Two couplers for each size of quick coupling valve.

1.8 SYSTEM SERVICE

- A. Inspect system at two and four weeks after Date of Substantial Completion and make necessary adjustments.

1.9 WARRANTY

- A. Entire sprinkler system will be unconditionally guaranteed against defects in material and workmanship, including repair of settling of backfilled areas below grade and adjusting heads to proper level for a period of one year from Date of Substantial Completion.
- B. Minor adjustments, any defective electrical controls, valves, sprinkler heads or other working parts will be repaired or replaced without cost to the Owner for a period of one year from the date of acceptance.
- C. Damage by others during the one-year guarantee period will be Owner's responsibility.
- D. Warrant sprinkler system to have 100 percent uniform moisture coverage of areas shown to be sprinkled.

PART 2 – PRODUCTS

2.1 MATERIALS – GENERAL

- A. The specified materials to be used shall be as designated on the contract drawings and this specification. All materials to be incorporated in this work shall be new and of the best quality, meeting the requirements for such materials and for the purposes intended. The irrigation lines on the contract drawings are diagrammatic. The Contractor shall be responsible for computing and supplying the required pipe, fittings, control wires and electrical accessories required to complete the project.
- B. Acceptable Manufacturers
 - 1. Hunter or Rain Bird or approved equal. Equipment may be mixed.
- C. Substitutions: All material shall be supplied and installed according to this specification and the specifications of the equipment and material manufacturers. Should contractor desire to substitute materials or equipment other than that described in this specification, the following procedures shall be followed:
 - 1. Provide manufacturer's specification for the proposed equipment and show how it is equal or better than the specified equipment.
 - 2. Demonstrate, if required by Owner, the actual performance of the equipment.
 - 3. Receive, from Owner, written approval for the proposed substitutions.
- D. Material Storage: A specific area shall be provided in which all materials to be used on the project shall be stored when not in use. Provision of this land is for the purpose of keeping the property neat and orderly and in no way waives any requirements of the Contractor to protect his equipment and materials from damage by the elements, from theft or from vandalism.

2.2 PIPE AND FITTING MATERIALS

- A. Pressurized Main Line Pipe: All 2 ½" and smaller main line pipe shall meet the latest requirements of ASTM D 1785 Standard Specification for Schedule 40 Poly (vinyl chloride) PVC pipe with size as shown on the project drawings. Solvent-weld sockets.

All main line pipe to be installed in curved sleeves shall be copper, Type L Soft and shall be the size required to meet the requirements of this specification. All transition fittings to PVC shall be copper sweat socket with threaded MIPT or FIPT connections to the PVC main line pipe.
- B. Lateral Pipe: All lateral pipe, downstream of the control valves, shall have solvent weld joints and shall meet the latest requirements of ASTM D 2241 Standard Specification for Poly (vinyl chloride)(PVC) Plastic Pipe with standard dimension ratio (SDR) of 21 and a Pressure Rating (PR) of 200 PSI.
- C. Sleeving Pipe: All sleeving (straight sections) to protect pipe or control wires at roads, sidewalks or below grade crossings shall be PVC Schedule 40. All sleeves (curved sections) to protect pipe or control wires at sidewalks and below grade crossing shall be high-density polyethylene with a working pressure of 160 psi. Sleeves shall be a minimum of two (2) times the diameter of the crossing pipe or that shown on the project drawings. Minimum sleeve size shall be 2" diameter. All irrigation control wires shall be routed in a separate sleeve with a minimum diameter of 2".

D. Fittings:

1. Tees attaching the electric control valves and quick coupling valves onto the mainline (2 ½" and smaller) shall be PVC Schedule 80 solvent welded or threaded fittings and shall meet ASTM D 2467 and ASTM D 2464 respectively. PVC Schedule 80 fittings and nipples shall be used on all fittings required between the mainline tap and the electric control valve as well as the threaded connection between the electric control valve and the lateral piping. Schedule 80 fittings shall be Spears Manufacturing or approved equal. Contract shall use manufacturer's recommended sealing compounds and/or Teflon tape according to manufacturer's recommended practice for the specific application.

Mainline fittings (2 ½" and smaller) at all points of direction change such as 22.5, 45, tees, or 90 degree turns shall be solvent weld with a minimum of Schedule 40 dimensions and shall meeting requirements of ASTM Specification D 2466-78. Schedule 40 fittings shall be Spears Manufacturing or approved equal.

Fittings for gasket-joint PVC pipe, for all directional changes, pipe reductions and plugs shall be deep bell push-on gasket joint ductile iron fittings for PVC pipe. Fittings shall be manufactured of ductile iron, grade 70-55-05 in accord with ASTM A536 and gaskets shall meet ASTM F477. Fittings shall be as manufactured by Harrington Corporation, Harco, or equal. For main line pipe to zone valve/lateral pipe connections, Harco or equal push-on gasket joint ductile iron service tees or ductile iron saddles. Ductile iron saddles shall be equal to Harco Ductile Iron Saddles as manufactured by Harrington Corporation. The saddles shall provide full support around the circumference of the pipe and an O'ring seal shall be provided so that there is no gap between the installed saddle and pipe and hydraulic pressure will complete the seal.

2. Lateral Line Fittings – Solvent welded fittings shall be Schedule 40 dimensions and wall thickness and shall meet the requirements of ASTM Specification D 2466 and shall be used on all piping downstream of electric control valves.
3. Solvent Cement: ANSI/ASTM D2564 for PVC pipe and fittings.
4. All ½" inlet spray heads shall be connected to the irrigation piping utilizing ½" thick walled polyethylene tubing (Rain Bird Model SPX-100) and appropriate insert fittings (Rain Bird Models SBE-050, SBE-075, SBA-050, SBA-075). Sufficient lengths of flexible pipe shall be used to form a sweeping arc to insure that spray heads are supported properly and allow for vertical adjustment and movement during service.
5. Any quick coupling valves shall be installed on prefabricated, manufactured swing joint assembly rated for 315 psi with pre-lubricated buttress threads and O'rings seals equal to Spears Manufacturing Co. Series 5807-01012.

- E. Swing Joints: Prefabricated, schedule 80 PVC, equal to Spears. Use for ground level pop-up impact driven heads, gear-driven rotary heads, hydrant and quick-coupler valves.

2.3 SPRINKLER HEADS AND NOZZLES

- A. Sizes and types noted on Drawing(s).

2.4 VALVES

- A. Automatic Control Valves: Remote, electrically operated, normally closed, diaphragm globe valves. The valve shall have a 200 psi CWP rating. Flow control stem shall be non-rising. The valve cover shall be secured to the body with stainless steel threaded studs and nuts. Bleeding of water during manual operations shall be either internal or external. Control valves shall be contamination resistant, glass filled high strength nylon body and bonnet. Sizes and types as indicated on Drawings(s).
- B. Isolation Valve for the Electric Control Valve: Ball type, plastic construction, with threaded ends. Valves shall have a maximum pressure rating of 235 psi at 73 degrees F. The valves shall be equal to Spears Model 2131-OXX sized the same as the control valve.
- C. Gate Valves (Isolation Shut off Valves): 2 ½" and smaller – shall be bronze, threaded, screw-in bonnet with non-rising stem rated for a 125 psi WSP and 200 psi non-shock WOG. The valve shall be domestic manufacture, shall meet Federal Specifications MSS SP-80 equal to Hammond Model IB645.
- D. Automatic Drain Valves: Equal to King Technology, Inc. Model 22, ½" inlet.
- E. Manual Drain Valve: Bronze body, angle type 150 psi class, with cross-type operating handle designed to receive a valve operating key.
- F. Backflow Preventer: Provide a Reduced Pressure Backflow Preventer for irrigation system use located adjacent to the irrigation water meter. RPZ to be housed in fiberglass enclosure on concrete base.

2.5 WATER METER

- A. The Irrigation Contractor is responsible for setting the meter. Comply with local codes for installation requirements and permitting. Contractor to provide meter, and obtain permits and inspection.

2.6 CONTROLLER

- A. Type noted on Drawing(s), including fittings and accessories.

2.7 VALVE BOXES AND MARKERS

- A. For Automatic Control Valves: Equal to Carson Industries Inc. model 1419-3 with 1419-6X extensions as required.
- B. For Manual Drain Valve: Equal to Carson Industries, Inc. model 910-10 w/corrugated plastic pipe for extension.

1. For Quick Coupling Valves: Equal to Carson Industries Inc. model 1419-3 with 1419-6X extensions as required.
 - C. For Above Grade Backflow Preventers In Exterior Locations: Fiberglass enclosure equal to “Hot Box” manufactured by Northeast Florida Enterprises, Inc. 1/800-736-0238. Place on concrete slab and anchor with 4 bolts. Size to fit backflow preventer. Provide electrical connection and heater or heater cable as recommended by enclosure manufacturer.
- 2.8. CONTROL VALVE WIRING
- A. Wire: Type AWG-1UF, bearing U.S. approval, minimum 14 gauge. One common wire, No. 12 UF is required for each controller, or as required for the Hunter ACC-99D controller. Provide all grounding as required by manufacturer.
 - B. Splicing Materials: Sta-Kon no. P7-70 connector and Scotchlok no. 3576 sealing pack. Scotchcote sealer for splices, or as required for the Hunter ACC-99D controller.
- 2.9 ENVIRONMENT CONDITION SENSEORS
- A. Rain Sensor – Equal to WSS manufactured by Hunter
 - B. Freeze Sensor- Equal to WSS manufactured by Hunter

PART 3 – EXECUTION

3.1 PREPARATION

- A. Head locations and pipe routing are diagrammatic only and shall be adjusted during installation to compensate for prevailing winds, gradient, and landscaping to insure proper coverage with minimal overthrow.

3.2 TRENCHING

- A. Trench for sprinkler system to provide proper grades and slopes to drain points.
- B. Keep trenches free of debris, material or other obstructions that may damage pipe.

3.3 INSTALLATION

- A. Install sleeves under paving and other improvements prior to construction. Install where required to accommodate piping at proper depth to prevent damage by other construction activities and to provide specified burial depth for irrigation pipe. Location of sleeves to be recorded and marked.

- B. Install pipe, valves, controls and sprinklers in accordance with manufacturer's instructions. Connect to water and electrical service. All work to be accomplished in accordance with applicable codes.
- C. All main line piping to be installed will a minimum of 18 inches cover and lateral piping with 12 inches minimum cover. Bed pipe on solid base free from rocks and other deleterious materials.
- D. Set sprinkler heads and valve box covers at finish grade. Valve boxes shall be placed in groundcover areas where possible. Rectangular valve boxes to be placed parallel to nearby curbs and walks or other improvements.
- E. Provide for thermal movement.
- F. Install automatic drain valves at all low sections of lateral piping (lines downstream from valves) to insure complete drainage of system when not in use. Wrap each valve with approved filter fabric.
- G. Install manual drain valves at all low sections to mainline (upstream lines) piping to permit complete drainage of system when not in use. Provide 12-inch depth gravel sump below each valve.
- H. Install all heads on approved swing-joints or nipple connections as shown on Drawings.
- I. Spray nozzles in shrub or other planting bed to be installed on risers of specified materials unless otherwise noted. Height of riser to be sufficient to provide complete coverage and allow for 1 to 2 years of plant growth.
- J. Install subsurface drip in locations indicated on plans and in accordance with manufacturer's recommendations. All such tubing to be completely concealed from view by covering with mulch.
- K. Install control wiring:
 - 1. Place the excess wire in a 10 inch expansion coil at each valve to which controls are connected and at 100 foot intervals. Control wiring may be installed in the same trenches with the irrigation piping. Wiring shall be bundled and taped with electrical tape at 10 foot intervals the entire length of each run. Wiring shall be installed on the north or east side of the pipes. Wire shall not be taut in the trench and expansion loops shall be provided to prevent the wire from being tensioned by backfilling or other subsequent construction. The side of the trench in which the wires are located shall be free of stones and other hard material which might injure the wire insulation. Backfill material placed against the wires shall be select material especially free from stones or other material which might injure the insulation.

A minimum of 24" wire for an expansion loop shall be allowed at each valve for contraction of wire or tightening of wire due to back-filling of trenches or possible valve services or replacement.

Splices outside of valve locations are not allowed. All connections at the electric control valves shall be water-proofed with the system in Section 2.08 "Wiring".

2. Install four (4) additional control wires from the controller to the furthest points along the main line with two wires on each side of the main. Terminate the wires with waterproof connections at the furthest valve-box location from the controller and note location on the as-built drawing.
- L. After piping is installed, before sprinkler heads are installed and backfilling commences, open valves and flush system with full head of water.
- M. Backfill trench and compact to finish grade elevation. Fill material placed within 12 inch of pipe to contain no rock or gravel particles greater than ½ inch in diameter. Protect piping from displacement. All settlement after backfill to be repaired.
- N. Arrange and coordinate installation of water meter.
- O. Provide concrete thrust blocks at changes in direction (at ells and tees) of mains and at termination of mains. One cubic foot minimum. Size of blocks and location to be in strict accordance with pipe manufacturer's specifications. Size shall be adequate and so placed to take all thrust created by maximum internal water pressure.
- P. Set valve box covers level at finish grade. Rectangular valve boxes to be placed parallel to nearby curbs and walks or other improvements. Valves and valve boxes shall be installed where shown or directed, and shall be set plumb. Valve boxes shall be centered on the valves. Where feasible, valves shall be located outside the area of natural walkways or paths and shall be placed in groundcover areas where possible. Earth fill shall be carefully tamped around each valve box. Valve boxes should be supported or blocked such that any surface loads on the valve boxes will not be transmitted below to the pipe or valves. Washed gravel sumps shall be provided below all valve boxes to permit drainage of water away from valves. Minimum depth of gravel sump is 8 inches.
- Q. Install at least two (2) automatic drain valves per zone at all low points sections of lateral piping (lines downstream from valves) to insure complete drainage of system when not in use.
- R. All sprinklers shall be installed on flexible connections or swing joints as specified in Section 2.2 "Pipe and Fitting Materials" and shall be set plumb and level with the final turf grade.
- S. All trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, soft shale, or other approved materials, free from large clods or earth or stone. Rock, broken concrete or pavement, and large boulders shall not be used as backfill material. The backfill shall be thoroughly compacted and evened off with the adjacent soil level. Selected fill dirt or sand shall be used if soil conditions are as discussed above. The fill dirt or sand shall be used in filling four (4) inches above the pipe. The remainder of the backfill shall contain no lumps or rocks larger than one (1) inch. The top six (6) inches of backfill shall be free of rocks or gravel particles over one-half (1/2) inch in diameter, subsoil or trash. Open trenches or partially backfilled trenches shall be kept to a minimum and effort shall be made to completely backfill that trench opened each day. The Contractor will be responsible for restoration of all settlement for a period of one year from acceptance.

- T. The irrigation controller shall be mounted inside the specified cabinet securely, level and plumb at the specified location shown on the contract drawings according to manufacturer's recommendations. Electrical conduit PVC sweep ells shall be used for the entering and exiting of the 24 volt control wires into the conduit entering the controller. Controllers shall be connected to the appropriate valves as indicated on the contract drawings. Electrical power supply to the controller shall be installed according to local electrical codes and shall be provide contractor.
- U. Rain and freeze sensors shall be installed according to manufacturer's recommendations and shall be installed at locations approved by Owner.
- V. Clean area and remove all debris and excess materials from site.
- W. Install pre-fabricated enclosure over backflow preventer. Place on 4" thick concrete pad sized to accommodate attachment per manufacturer's requirements. Provide electrical connection and install heater or heat cable.

3.4 TESTS

A. Static Pressure Test

1. The entire main line system shall be constructed to successfully withstand, when completed, a full static pressure of 100 psi (whichever is greater) for a period of 6 hours with no resulting flow or pressure loss.
2. The testing for leakage shall be conducted with the observation of the Owner and all pipe, joints and appurtenances will be inspected while the system is under test pressure and leaks corrected as directed. The testing shall extend over a period of up to six (6) hours to allow for a complete inspection.

B. Performance Test

1. Upon completion of the irrigation system installation including all pressure tests, Contractor shall conduct a performance test of the complete system to insure that all components are functioning properly. Performance test shall consist of operating the system through a complete irrigation cycle per day for two (2) consecutive days. Contractor shall be at the site to monitor the performance tests and make any adjustments and corrections as needed during the testing period.
2. The Contractor shall balance and adjust the various components of the system so that overall operation of the system is most efficient. This includes adjustment to pressure regulators, part-circle sprinkler heads and individual station adjustments on the controllers.
3. Repair grades and re-dress mulch in planted areas disturbed by final testing and adjustment.

END OF SECTION 328400

SECTION 330800

SEWER MANHOLES, FRAMES, AND COVERS

GENERAL

1.1 SUMMARY

1.2 Section Includes

1. Monolithic concrete, modular precast concrete, masonry, and precast polyethylene manhole assemblies.

1.3 Related Sections

1. Section 031200 - Earthwork. Excavation, backfill, and compaction
2. Section 334100 - Storm Drainage

1.4 REFERENCE STANDARDS

A.

1. ASTM A 48 - Gray Iron Castings
2. ASTM C 55 - Concrete Building Brick
3. ASTM C 478 - Precast Reinforced Concrete Manhole Sections
4. ASTM C 923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
5. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials

B. International Masonry Industry All-Weather Council (IMIAC)

1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction

C. State Department of Transportation (DOT), Construction and Material Specifications

1.5 SUBMITTALS

- A. Shop Drawings: Indicate reference to Construction Drawings of manhole locations, elevations, piping with sizes, locations, and elevations of penetrations.

- B. Product Data: Provide data for manhole covers, component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MANHOLES

- A. Cast-In-Place Concrete: Nonreinforced cast in place concrete barrel.

1. Concrete: 3500 psi concrete
2. Forms: Steel sheet accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.

- B. Precast Concrete: Reinforced precast concrete barrel.

1. Manhole sections conforming to ASTM C 478 with gaskets in accordance with ASTM C 923.
2. Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated.

- C. Concrete Brick: ASTM C 55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches
- D. Precast Polyethylene:
 - 1. Manufacturer: Advanced Drainage Systems (ADS) or approved equal.
 - 2. Precast polyethylene in accordance with ASTM D 1248. Nominal cylinder internal diameter shall be 48-inches and shall be designed to accept concrete filled polyethylene manhole lids and standard cast iron frames with lid or grate.
 - 3. Manholes shall have compressive strength that meets ASTM D 2412 standards.
- E. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-inches deep shall be repaired using Class "D" mortar.
- F. Brick Transition Reinforcement: Formed steel 8-gauge wire with galvanized finish.
- G. Configuration:
 - 1. Barrel Construction: Concentric with eccentric cone top section.
 - 2. Shape: Cylindrical
 - 3. Clear Inside Dimensions: 48-inches diameter minimum or as indicated on Construction Drawings.
 - 4. Design Depth: As indicated on Construction Drawings.
 - 5. Clear Lid Opening: 22-inches minimum
 - 6. Pipe Entry: Provide openings as indicated on Construction Drawings
 - 7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.
- H. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

- A. Lid and Frame:
 - 1. Manufacturer: Neenah Foundry Company, East Jordan Iron Works, or approved equal.
 - 2. ASTM A 48, Class 30B heavy duty cast iron construction, machined flat bearing surface.
 - 3. Removable lid, closed or open as indicated on Construction Drawings, sealing gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items specified by other Sections are properly sized and located.
- B. Verify that built-in items are in proper location and ready for roughing into work.
- C. Verify that the excavation for manholes is correct.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.3 PRECAST MANHOLE CONSTRUCTION

- A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.
- B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
 - 1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.
 - 2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.
- C. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

3.4 CAST-IN-PLACE MANHOLE CONSTRUCTION

- A. Cast-in-place shall conform to the applicable requirements. Utilize steel forms.
- B. Place base pad to proper elevation and location and pour monolithically with invert. Base shall support pipe to first joint.
- C. Deposit concrete in evenly distributed layers of about 18 inches, with each layer vibrated to bond to preceding layer.
- D. Place gasket between all joints and paint exterior of manhole within 5' of the joint with mastic waterproofing.
- E. Place precast concrete cone.
- F. Set section cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

3.5 MASONRY MANHOLE CONSTRUCTION

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Lay masonry units in running bond. Course 3 brick units and 3 mortar joints to equal 8 inches.
- C. Form flush mortar joints
- D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- E. Install joint reinforcement 16 inches on center
- F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening

- G. As work progresses, build in fabricated metal items
- H. Cut and fit masonry for pipes as specified herein
- I. Set cover frames and covers level to correct elevations without tipping.

3.6 TESTING

- A. General:
 - 1. All sanitary sewer manholes shall be inspected and tested tested for water tightness or damage prior to acceptance by the owner and engineer. If a manhole fails the test, the Contractor shall locate the leak and make proper repairs and re-test. The owner or engineer reserves the right to refuse leaking manholes, in which case the Contractor will replace the manhole at his expense.

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Storm sewer drainage piping, fittings, and accessories.
 - 2. Storm drainage structures.

1.2 Related Requirements

- 1. Section 312000 - Earthwork
- 2. Section 312800 - Erosion and Sedimentation Control
- 3. Section 033000 - Cast-In-Place Concrete

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M36 - Zinc Coated (Galvanized) Corrugated Iron or Steel Culverts and Under Drains
 - 2. AASHTO M190 - Bituminous Coated Corrugated Metal Culvert Pipe and Arches
 - 3. AASHTO M252 - Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter
 - 4. AASHTO M294 - Corrugated Polyethylene Drainage Tubing, 12 to 48 Inch Diameter
 - 5. AASHTO MP7-97 - Corrugated Polyethylene Drainage Tubing, 54 to 60 Inch Diameter
 - 6. AASHTO M198 - Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets
 - 7. AASHTO H170 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A74 - Cast Iron Soil Pipe and Fittings
 - 2. ASTM A185 - Steel welded Wire Fabric, Plain, for Concrete Reinforcement
 - 3. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 4. ASTM A746 - Ductile Iron Gravity Sewer Pipe
 - 5. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - 6. ASTM C150 - Portland Cement
 - 7. ASTM C206 - Finished Hydrated Lime
 - 8. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
 - 9. ASTM C564 - Rubber Gasket for Cast Iron Soil Pipe and Fittings
 - 10. ASTM C969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
 - 11. ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
 - 12. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - 13. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 14. ASTM F949 – Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings
- C. American Concrete Institute (ACI)
 - 1. ACI301 - Structural Concrete for Buildings

1.4 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide shop drawings for precast inlets, catch basins and junction boxes.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.
- C. Project Record Documents
 - 1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

- A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Reinforced Concrete Pipe (RCP): ASTM C76, Class III unless noted otherwise on Drawings, installed with flexible plastic, bitumen gaskets at joints.
 - 1. Gaskets: AASHTO M 198 751, Type B or ASTM C 443, installed in accordance with manufacturer's recommendations.
 - 2. Flared end sections shall be per ASTM C76 or AASHTO H170 (for sections with toe wall)
- B. High Density Polyethylene Pipe (HDPE): AASHTO Designation M252 Type S, M294 Type S and MP7-97 Type S, smooth interior/annular exterior. Only permitted when specifically indicated on Drawings. Pipe shall be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications.
 - 1. Pipe Joints and fittings shall conform to AASHTO M252 and M294.
 - 2. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved equal.
- C. Spiral Rib Metal Pipe: ASTM A 760 Type 1R or Type IIR. Coatings shall meet requirements of ASTM A929 and shall be galvanized, aluminized, or bituminous coated as specified on Drawings. Only permitted when specifically indicated on Drawings.
 - 1. Pipe ends shall be re-corrugated and installed with semi-corrugated "Hugger" type bands and "O" ring gaskets in accordance with pipe manufacturer's installation requirements.
 - 2. Pipe gauge shall be as specified on construction drawings or if no gauge is given then the minimum gauges are as follows: 15" to 42" diameter round pipe – 16 gauge (0.064"), 48" to 60" round pipe – 14 gauge (0.079"), 66" to 78" round pipe – 12 gauge (0.109"), 15" to 30" pipe arch – 16 gauge (0.064"), 36" to 42" pipe arch – 14 gauge (0.079"), and 48" to 78" pipe arch – 12 gauge (0.109"). Gauges for larger diameters shall be indicated on the drawings.
 - 3. Installation shall be in accordance with ASTM A798 and A796 as they apply, manufacturer's requirements, and as indicated on the drawings.
 - 4. Standard corrugated steel pipe as described in section E of these specifications shall not be substituted for any diameter of Spiral Rib Steel Pipe.
 - 5. Manufacturer: Contech, Inc. "Ultra Flo or Ultra Flo II", Southeast Culvert, Inc. "Max Flow", St. Regis Culvert, Inc. "Max Flow", Thompson Culvert, Inc. "Max Flow", or approved equal.

- D. Polyvinyl Chloride (PVC) Pipe: ASTM D3034, rated SDR 35 (or ASTM 949 for Profile Pipe) continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Only permitted when specifically indicated on Drawings.
 - 1. Pipe joints: ASTM D 3212 using restrained gasket conforming to ASTM F477.
- E. Corrugated Steel (Metal) Pipe (CSP or CMP): ASTM A 760, 16 gauge unless another gauge is indicated on Drawings. Galvanized, aluminized (Type 1R), or bituminous coated as specified on Drawings. Only permitted when specifically indicated on Drawings. Corrugated steel pipe may be round pipe, arch pipe, or slotted drainpipe as indicated on Drawings. Slotted drainpipe shall have 1.75-inches wide drain waterway openings and 6 inches minimum height drain guide
 - 1. CSP, bands and appurtenances shall be uniformly coated inside and outside with a 0.05 inch minimum thickness bituminous coating in accordance with AASHTO M190. .
 - 2. CSP shall be supplied with paved inverts or fully lined to provide a smooth interior, smooth flow lining only as indicated on the drawings.
- F. Ductile Iron Pipe (DIP): ASTM A746
 - 1. Fittings: Cast iron conforming to ASTM A74
 - 2. Joint Material: Rubber gasket conforming to the requirements of ASTM C564 for compression joints.
- G. Subdrains: Perforated, PVC or flexible corrugated plastic pipe as specified herein of the size indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with bedding material.
- B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.
- C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

- A. The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.

- B. Excavate pipe trench and place bedding material in accordance with Section 312000.
- C. Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream. Riveted CSP shall be placed with the inside circumferential laps pointing downstream. Repair damaged bituminous coating on CSP by applying bituminous material conforming to AASHTO M190.
- D. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Drawings.
- E. Do not displace or damage pipe when compacting.
- F. No pipe shall be laid in water or when trench conditions are unsuitable for such work.
- G. Joints:
 - 1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions with the intent that they be made watertight.
 - 2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the larger diameters, which permit the entry of a man, annular space between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
 - 3. CSP shall be joined by standard corrugated connecting bands. Keep dirt or gravel out from between the pipes and band so that corrugations fit snugly. While being tightened, the bands shall be tapped with a mallet to take up slack and insure a tight joint.
 - 4. PVC fittings shall be attached to the pipe by solvent welding according to the manufacturer's recommendations.

3.4 SUBDRAINS

- A. Subdrains shall be installed in accordance with the details and at the locations shown on the drawings

3.5 INSPECTION AND TESTING

- A. General
 - 1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
 - 2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.
- B. Cleaning and Testing
 - 1. Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.
- C. Alignment Test

1. After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

END OF SECTION