GADSDEN CITY HALL

PROJECT MANUAL

100% CONSTRUCTION DOCUMENTS - BID SET

NOVEMBER 25, 2024

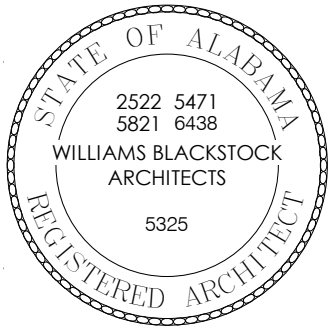
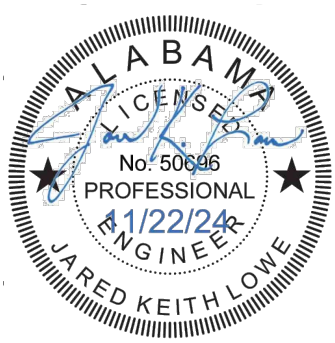
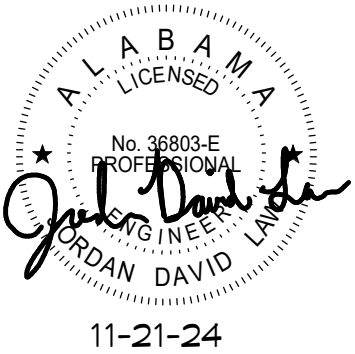
WBA Project No. 23-083.00

GADSDEN, ALABAMA

WILLIAMS BLACKSTOCK ARCHITECTS

SECTION 00 0107

SEALS PAGE

Architect Williams Blackstock Architects 	**Civil Engineer** CDG 	**Structural Engineer** Structural Design Group  11-21-24
Electrical Engineer Dewberry 	**Mechanical, Plumbing & Fire Protection Engineer** Dewberry 	**Landscape Architect** Johnson & Company 

END OF SECTION 00 0107

SECTION 00 0110

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END OF SECTION 00 0110

LEGAL NOTICE: NOTICE TO CONTRACTORS

NEW CITY HALL FOR CITY OF GADSDEN
WBA Project No.: 23-083.00

Prequalification statements are solicited for General Contractors interested in bidding on the new City Hall project for the City of Gadsden. This project includes the renovation of two existing buildings and the construction of an addition between those to create a new City Hall. The site is located off Broad Street in the city block between 2nd and 3rd Streets. Selective demolition will be required to complete the renovations. Approximately 23,400 SF of the existing 3-story Regions building will be renovated, which is the entire building minus the recently renovated Region's tenant space on the first floor. The existing 2-story Merrill Lynch building, which has a total area of approximately 14,000 SF, will have limited scope. With the construction of a new 15,500 SF Council Chamber addition, the entire combined building area, including renovated and new space, will be 64,000 SF to serve the city's current and future growth needs.

Within the Regions and Merrill Lynch buildings, new MEP and FP systems will be provided at select areas to complement the new systems that are being provided within the addition. Regions Bank, Merrill Lynch, and CDG are all tenants which will occupy the existing buildings during construction. No work is planned for the Regions tenant space; however, some limited MEP and FP upgrades are planned for the Merrill Lynch building. Sitework such as grading, utilities, and stormwater drainage will be provided to accommodate the new addition and tie it in with the surrounding buildings and infrastructure. New landscaping and irrigation improvements are also planned. All the work must be phased by the GC as outlined on the construction drawings to minimize tenant disruptions and maintain their business operations.

Pre-qualification packages and project summary information will be made available **October 28, 2024** by contacting Williams Blackstock Architects c/o Sean Whitt via e-mail at sean@wba-architects.com. Prequalification packages are to be submitted no later than 5:00pm local time on **November 15, 2024** via electronic copy emailed to sean@wba-architects.com. Notification of successful respondents will be issued no later than 12:00pm local time on Thursday, November 21, 2024, at which time final bid documents will be made available. Additional qualifications and requirements for General Contractor Bidders are indicated in the Bid and Contract Documents.

Sealed proposals will be received by the City of Gadsden **until 2:00 PM local time on Tuesday, December 17, 2024 at the Council Chambers at City Hall.**

Final plans and specifications for use in preparing bids will be available digitally to prequalified General Contractors only from Williams Blackstock Architects, c/o Sean Whitt (sean@wba-architects.com) after 12:00 Noon local time on Thursday, November 21, 2024. Only General Contractors who have completed the prequalification process within the stated time limits, and which are properly licensed in accordance with criteria established by the State Licensing Board for General Contractors under the Provision of Title 34, Chapter 8, Code of Alabama, 1975, as amended, will be considered for prequalification for the Work of this project.

Questions regarding this project should be directed, in writing, to the Architect, Sean Whitt at sean@wba-architects.com no later than three (3) business days prior to bid opening.

A mandatory pre-bid conference will be held on Tuesday, November 26, 2024 at 2:00 PM local time at the Council Chambers at City Hall for the purpose of reviewing the project and answering Bidder's questions. **Attendance at the Pre-Bid Conference IS REQUIRED for all prequalified General Contractor Bidders** intending to submit a Proposal. Bids from General Contractors not attending the Pre-Bid Conference will be rejected. A site visit immediately following the pre-bid conference will be conducted, which is recommended but does not require attendance.

Bids must be submitted on proposal forms furnished by the Architect or copies thereof. All bidders bidding in amounts exceeding that established by the State Licensing Board for Contractors must be licensed under the Provision of Title 34, Chapter 8, Code of Alabama, 1975, as amended, and must show such evidence of license before bidding or bid will not be received or considered by Architect or Owner; the bidder shall show such evidence by clearly displaying their current license number on the outside of the sealed envelope in which the proposal is delivered and on the Proposal Form.

Prior to the award of a competitively bid contract to a contractor having one or more employees in the state of Alabama, Alabama law requires that the contractor provide the city proof of enrollment in E-Verify (see www.uscis.gov/everify).

No bid shall be withdrawn for a period of thirty (30) days subsequent to the opening of bids without the consent of the City of Gadsden.

The bidder shall file with his bid either a cashier's check drawn on an Alabama bank, payable to the City of Gadsden, Alabama, or a bid bond executed by a surety company duly authorized and qualified to make such bonds in Alabama, in an amount equal to the lesser of five percent (5%) of the bid or ten thousand ($10,000).

Bidders must comply with the President's Nos. 11246 and 11375 which prohibit discrimination in employment regarding race, creed, color, sex, or national origin. Bidders must also comply with Title IV of the Civil Rights Act of 1964, Title VIII of the Civil Rights Act of1968, and Section III of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 170lu.

Bidders must certify that they do not and will not maintain or provide for their employees any facilities that are segregated on a basis of race creed, color, sex, or national origin. Bidders must also certify they will make facilities handicap accessible to the extent required by law.

The Owner reserves the right to reject any or all proposals, to waive technical errors and/or abandon the prequalification and bid process if, in their judgment, the best interests of the Owner will thereby be promoted.

ADVERTISEMENT DATES:

The Messenger:
October 25, 2024

SECTION 00 3100

INFORMATION AVAILABLE TO BIDDERS

REPORTS AND SURVEYS

1.01 SUBSURFACE INVESTIGATION REPORT

A. A copy of a geotechnical report with respect to the building site is included with this document:

1. Title: Subsurface Exploration and Geotechnical Engineering Evaluation
2. Date: October 5, 2024.
3. Prepared by: CDG 6767 Old Madison Pike – Suite 400; Huntsville, AL 35806

B. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.

C. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

D. The Contractor is responsible for ensuring dry conditions on the site throughout the sitework. If required, the Contractor is responsible for dewatering the site using wells, pumps, and means necessary to direct perched groundwater to the storm drainage system to maintain dry conditions.

E. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

1.02 SITE SURVEY

A. See Drawings.

END OF SECTION 00 3100

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

Gadsden City Hall

October 25, 2024

PREPARED FOR

City of Gadsden
90 Broad Street
Gadsden, Alabama 35901

PREPARED BY

CDG, Inc.
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Huntsville, Alabama 35806

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October 25, 2024

City of Gadsden
90 Broad Street
Gadsden, Alabama 35901

Attention: Mr. Heath Williamson, PE – City Engineer

Reference: **Report of Subsurface Exploration and Geotechnical Engineering Evaluation**
Gadsden City Hall
Gadsden, Etowah County, Alabama
CDG Reference Number: R628124011

Dear Mr. Williamson:

CDG, Inc. (CDG) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Gadsden City Hall in Gadsden, Etowah County, Alabama. Our services were performed in general accordance with a *Proposal to Provide Subsurface Exploration, Geotechnical Engineering Evaluation and Construction Materials Testing Services* dated September 25, 2024.

The purposes of this study were to determine general subsurface conditions at specific soil test boring locations and provide geotechnical recommendations relative to the site work and foundation phases of construction. This report presents the subsurface information encountered at the test locations, laboratory test results of representative, on-site soil samples, and our recommendations associated with the proposed development.

We appreciate the opportunity to work with you and look forward to our continued involvement during the construction phase of the project. Please call if you have any questions or need additional information.

Respectfully Submitted,
CDG, Inc.

Connor Moore, EI
Staff Professional

Allen Yates, PE
Project Manager

ALABAMA LICENSED No. 30466 PROFESSIONAL ENGINEER ALLEN JOHNSTON YATES
10/25/24

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APPENDICES

1.0 SCOPE OF SERVICES

Our services included performing a subsurface exploration, conducting field and laboratory soil tests, and preparing a geotechnical engineering report of our findings. The following is the specific scope of services performed for the Gadsden City Hall project:

- Site reconnaissance and geologic map review.
- Mobilization of a Diedrich D-50 drilling rig.
- Six (6) soil test borings (B-1 through B-6) were performed in the proposed development area. A seventh boring could not be completed due to utility conflicts. The borings contained Standard Penetration Tests at 2½-foot intervals in the upper 10 feet and on 5-foot centers thereafter. The borings were performed on September 30, 2024 and extended to depths ranging from approximately 17 to 20½ feet below the existing ground surface, at which depths the borings were terminated or auger refusal was encountered.
- Laboratory tests to determine site-specific soil classification characteristics. Tests included the following: Natural Moisture Content (14 tests), Grain Size Analysis (4 tests), and Atterberg Limits (4 tests).
- Evaluation of the information gathered during the subsurface exploration and laboratory testing program and preparation of this geotechnical engineering report. The report addresses the following items:
    - Site and project description.
    - Local geology and its implications for the proposed construction.
    - Subsurface conditions encountered in the borings.
    - Groundwater levels at the time of the field work.
    - Laboratory test results.
    - Earthwork recommendations including subgrade preparation, excavation and fill placement, treatment of unsuitable soils, and groundwater control.
    - Foundation recommendations including type, support parameters, expected total and differential settlements, site class for seismic design purposes and construction considerations.
    - Floor slab support and modulus of subgrade reaction recommendations.
    - Pavement-area subgrade preparation considerations

2.0 SITE AND PROJECT DESCRIPTION

The proposed Gadsden City Hall is located in the southeastern quadrant of Section 4, Township 12 South, Range 6 East in Gadsden, Etowah County, Alabama. Specifically, the site is located within an existing city block bound by Broad Street, Chestnut Street, South 2nd Street, and South 3rd Street. A *Site Vicinity Map* is included in **Appendix A**.

At the time of the field work (9/30/2024), the site contained two (2) existing office buildings with associated parking and drive areas. The buildings were 2 to 3 stories in height and appeared to be constructed with concrete slabs-on-grade, masonry or wood framing, and metal roofing. The west portion of the site contained asphalt paving, while the east portion of the site contained concrete paving. Curb and gutter was present along both sides of all the nearby roadways. Improvements associated with the nearby developments consisted of overhead/underground utility lines and asphalt and concrete surfaced driveways. The following pictures indicate the conditions observed at the time of the site visit.

Looking Northeast Towards Broad Street

Looking North Towards 2-story Building

Looking Northeast Over Asphalt Parking

The two existing buildings will be repurposed for the City Hall facility. A new, approximately 7,650 square foot, 2-story structure to house the City Council chambers and support offices will be constructed between the existing buildings. The new structure will be built with a steel frame and composite flooring. The main assembly space for the structure will be on the ground level. Additionally, portions of the existing parking lots will be reconfigured.

Proposed site grading and precise structural loads were unavailable at the time of report preparation. However, based on review of available street level imagery and field observations, we have assumed that existing proposed cuts and fills will be less than 5 feet. Maximum column and wall loads were assumed to be less than 150 kips and 7.5 kips per linear foot, respectively.

3.0 FIELD AND LABORATORY SOIL TESTING

3.1 Soil Test Borings

The field investigation included performing six (6) borings in the proposed development area. The sampling and penetration procedures of the soil test borings were performed in general accordance with ASTM D-1586, using a power rotary drill rig. Standard Penetration Tests (SPT) were performed in the soil borings by driving a standard 1⅜-inch inside diameter and 2-inch outside diameter split spoon sampler with a 140-pound hammer falling 30 inches.

The number of hammer blows required to drive the sampler a total of 18 inches, in 6-inch increments, were recorded. The penetration resistance, or "N" value, is the sum of the blows required to drive the sampler the final two 6-inch increments. The N-values are indicated on the *Boring Logs* in **Appendix C** adjacent to their corresponding depths. Penetration resistance is used as an indicator of various soil parameters from empirical correlations.

3.2 Laboratory Testing

During the field investigation, a representative portion of each recovered sample was sealed in plastic bags and transported to our laboratory for engineering classification (ASTM-2487) and laboratory testing. The description and stratification of the soil conditions, using the Unified Soil Classification System, are illustrated in the form of soil profiles on the *Boring Logs* in **Appendix C**. To aid in soil classification and determining site-specific soil characteristics, selected soil samples were tested for natural moisture content (ASTM D-2216), Particle Size Analysis (ASTM D-6913), and Atterberg Limits (ASTM D-4318).

4.0 LOCAL GEOLOGY

A review of available geologic data (digital GIS data provided by the USGS) indicates that the site is located in the Valley and Ridge Physiographic Region. The Valley and Ridge is characterized by ridges trending northeast to southwest. The ridges are typically composed of dolomite, sandstone and chert. The valleys are generally underlain by limestone and shale. Specifically, this site is located near the contact of Low Terrace Deposits and the Conasauga geologic formation. A *Site Geology and Documented Sinkhole Map* is provided in **Appendix A**.

Terrace deposits refer to relatively recent (Quarternary), water-deposited soil typically associated with ancient or existing rivers, streams, and other waterways. The site is located approximately 1,000 feet west of the Coosa River. Therefore, the terrace deposits at the site appear to have resulted from the meanderings and flooding of this waterway. Terrace deposits within the Gadsden area generally consist of quartz sand containing clay lenses and angular to subrounded gravel.

The nearby and underlying Conasauga formation consists of fine-grained limestone with interbedded, dark gray shale. The overlying, residual soils typically consist of clay and chert fragments with varying amounts of silt and fine sand. The clay can exhibit a high plasticity in both the Conasauga and terrace deposits.

Plasticity is a measure of a soil's potential for volume change. Plastic soils shrink and swell with variations in natural moisture content. Additionally, springs are often encountered in the geologic formations present at the site. Springs typically develop when water becomes trapped within the joints of the rock and in the overlying residual soils. Water flow can be present continually; however, additional springs and greater flow rates are generally present during periods of high rainfall.

Geologic formations containing limestone can exhibit highly variable depths to intact rock. Continuous rock may be present at the ground surface or at depths in excess of 100 feet. Initial weathering in the limestone occurs along joints and fissures in the rock. Water present in the rock joints accelerates the weathering process forming an irregular rock surface. Therefore, pinnacles, slots, and mud-filled voids form within the rock. Advanced weathering of rock pinnacles leads to the formation of boulders suspended within the residual soil matrix and deep slots filled with very soft, wet soils.

Subsurface voids (dolines), depressions, and sinkholes occur in geologic formations containing soluble rock such as limestone. These formations are known as karst geologies. Circulating groundwater dissolves the carbonate portion of the limestone over geologic time. As the carbonate portion of the limestone dissolves, voids and caverns develop underground. The doline can propagate upward toward the ground surface and can result in subsidence or collapse of the overlying soil. Groundwater movement causing erosion of soil overburden is typically necessary for the formation of dolines in the karst geologies of Alabama. Available sinkhole data (digital GIS data from the Geological Survey of Alabama) indicates that sinkholes have been documented within ±¼ miles of the site. The noted data is reproduced as part of the *Site Geology and Documented Sinkhole Map*.

Due to the geologic formations underlying the site and the presence of documented sinkholes within the site vicinity, there is a risk of future sinkhole activity at the site. However, no evidence of ground surface subsidence or dolines was observed at the site during the field work or in the borings. Therefore, the risk of sinkhole development appears to be no greater at the subject site than at surrounding locations.

We note that the action of sinkholes is irregular and cannot be precisely predicted. Therefore, the site should be carefully monitored for subsidence, depressions, and sinkholes. Additional engineering evaluation and remediation will be required should further evidence of sinkhole activity be observed at the site during or after construction.

5.0 SUBSURFACE CONDITIONS

The field investigation included performing six (6) borings in the proposed development area. The locations of these borings were established by pacing distances and estimating angles from existing site features; therefore, they are approximate. The approximate locations of the borings are shown on the *Boring Location Plan* in **Appendix B**.

Details of the conditions encountered at the boring locations are contained on the *Boring Logs* in **Appendix C**. The stratification lines indicated on the logs represent the approximate boundaries between soil types. The actual transitions may be gradual. The soil conditions noted on the logs represent conditions encountered at the location and time tested. Significant changes in subsurface conditions can occur over a short distance or period of time. The general subsurface conditions encountered at the test locations are described below.

5.1 Surficial Materials

Boring locations were performed through existing asphalt or concrete pavements. Concrete was encountered at three (3) boring locations (B-1, B-4, and B-5). The thickness of the concrete ranged from approximately 3 to 12 inches and averaged 9 inches at the tested locations. Crushed limestone was found beneath the concrete. The thickness of the crushed limestone associated with the concrete ranged from approximately 4 to 6 inches and averaged 5 inches.

Asphalt was encountered at three (3) boring locations (B-2, B-3, and B-6). The thickness of the asphalt was measured at 2 inches at the tested locations. Crushed limestone was found beneath the asphalt. The thickness of the crushed limestone associated with the asphalt ranged from approximately 6 to 8 inches and averaged 7 inches.

5.2 Existing Fill

Previously placed fill was encountered at all six (6) boring locations (B-1 through B-6). The fill appears to be associated with the existing development on the site. The existing fill was encountered immediately beneath the existing pavements and consisted of sandy lean and fat clay and silty clay. Portions of the fill contained asphalt fragments, slag, and emitted an organic odor. The fill extended to a depth of ±5½ feet below the existing ground surface.

Standard Penetration Test (SPT) N-values within the existing fill ranged from weight-of-hammer (WOH) to 10 blows per foot (bpf). Weight-of-hammer indicates that the spoon sampler dropped through the designated test interval without the need for hammer impact. The unconfined compressive strengths (PP_{qu}) of cohesive samples of the fill were measured using a hand-held penetrometer. PPqu values within cohesive samples of the existing fill ranged from less than 0.25 to 1.75 tons per square foot (tsf). Therefore, the existing fill exhibited a very soft to stiff (cohesive) consistency.

The natural moisture contents of selected samples of the existing fill ranged from 18% to 22%. A tested sample of the fill exhibited a moderate degree of plasticity with a Liquid Limit (LL) value of 33 and a Plasticity Index (PI) of 19. The sample contained 73% fine grained (silt and clay) particles. Based on the USCS classification guidelines, the existing fill sample is classified as sandy, lean clay (CL).

5.3 Terrace Deposits

Terrace deposits are soils deposited relatively recently by the meanderings of the nearby Coosa River. Terrace deposits were encountered in all six (6) soil test borings underlying the existing fill. The terrace deposits extended to ±17 and 18 feet below the existing ground surface.

The deposits generally consisted of sandy, fat clay and clayey sand with varying fractions of subrounded rock fragments and chert. SPT N-values within the terrace deposits ranged from 4 to greater than 50 blows per foot (bpf). PPqu values in cohesive samples of the terrace deposits ranged from 0.5 to greater than 4 tsf. Therefore, the terrace deposits exhibited a soft to hard (cohesive) or loose to medium dense (non-cohesive) consistency. Typically, lower consistency deposits were encountered immediately above auger refusal or the underlying decomposed rock.

The natural moisture contents of selected samples of the terrace deposits ranged from 8% to 30%. Tested samples of the terrace deposit soils exhibited a high degree of plasticity with Liquid Limit (LL) values ranging from 50 to 75 and Plasticity Indices (PI) ranging from 27 to 51. The samples contained 45.0% and 82.0% fine grained (silt and clay) particles. Based on the USCS classification guidelines, the terrace deposits are classified as fat clay (CH) or clayey sand (SC).

5.4 Decomposed Rock

Decomposed rock of the Conasauga geologic formation was encountered in four (4) borings (B-3 through B-6) underlying the terrace deposits. The decomposed rock samples were pulverized by the sampling technique and generally consisted of sandy clay with limestone or shale fragments. SPT N-values in the decomposed rock exceeded 50 bpf. The decomposed rock was initially encountered at a depth of ±16¾ below the existing ground surface. The drilling equipment penetrated between approximately 2 to 3½ feet of decomposed rock prior to auger refusal or boring termination.

5.5 Auger Refusal

Auger refusal is defined as the depth at which further penetration with available drilling equipment is impractical. At this site, a Diedrich D-50 with hollow-stem augers was utilized for the subsurface exploration. Auger refusal was encountered in five (5) borings at depths ranging from ±17 feet to ±20½ feet below the existing ground surface.

Refusal materials were not sampled. However, based on our experience with the geologic setting present at this site and the presence of overlying decomposed rock, refusal likely occurred on intact rock of the Conasauga geologic formation.

5.6 Groundwater

Groundwater levels were measured in each soil test boring at the time of excavation. Groundwater was not encountered at the time of exploration. The soil test borings were backfilled following groundwater measurement.

We note that perched groundwater is often present within a layered subsurface profile such as that present at the subject site (fill / terrace deposits / decomposed rock). Surface water can percolate through the upper, porous soils and become trapped over relatively impermeable deposits or rock. Groundwater depth is highly variable and will often fluctuate due to seasonal variations in precipitation.

6.0 EARTHWORK CONSIDERATIONS

Proposed site grading was unavailable at the time of report preparation. However, based on review of available street level imagery and field observations, we have assumed that existing elevations will be within approximately 5 feet of proposed grades. We are providing the following earthwork-related recommendations based on the plan information available at the time of report preparation. If significant changes are made to the development plans or if the noted grading information is inaccurate, CDG should be allowed to review our recommendations in light of the changes to determine if additional testing and revised conclusions are needed.

6.1 Subgrade Preparation

Prior to the start of excavation and fill placement, the proposed development area should be cleared of vegetation, topsoil, rootmat, all organic materials, and surficial materials not intended for reuse. As noted previously, the site contained both existing asphalt and concrete pavements underlain by crushed aggregate.

Additionally, the site should be cleared of existing improvements that will not be repurposed for the City Hall facility. Demolition should include all below-ground elements such as buried foundations and stem walls, basements, slabs, septic systems, wells and utility lines. All debris including buried trash, organics, rubble and other deleterious materials should be completely removed. Soils immediately underlying existing pavements, slabs and other ground-supported structures often exhibit a low-consistency. All soft soils exposed during demolition should be removed. Excavations resulting from site clearing and demolition should be backfilled in a controlled manner with structural fill.

Existing fill was encountered in all six borings (B-1 through B-6) to a depth of approximately 5½ feet below the existing ground surface. The N-values of the existing fill indicated a low consistency. Structures supported on undocumented fills or low consistency materials are likely to experience differential settlement and resultant distress. Typical distress may consist of cracking in rigid elements such as concrete floor slabs and masonry walls, windows and doors that stick, and premature distress and birdbaths in pavement areas. **Therefore, it is our opinion that the undocumented fill, in its current condition, is not suitable for support of proposed building structures.**

Therefore, subgrade preparation should include complete over-excavation of the existing fill in proposed building areas. Over-excavation should extend to expose the underlying, high-consistency terrace deposits and should continue to a minimum horizontal distance of 3 feet beyond the limits of proposed, exterior building foundations. Following excavation and prior to structural fill placement, the exposed soils should be scarified to a depth of 8 inches, moisture conditioned to within ±2% of the optimum moisture content, and re-compacted to the project requirements.

Pavements are typically less sensitive to differential movements than buildings. Therefore, provided the owner is willing to accept small differential movements, low-consistency soils in the proposed paved areas may be stabilized in lieu of mass over-excavation.

Stabilization should consist of partially undercutting the existing fill to a **minimum** depth of 24 inches below the proposed final subgrade elevation. Where very low consistency soils are present, greater undercut depths may be required. Over-excavation should continue a horizontal distance of 5 feet beyond the edge of pavements or back of curb. Exposed materials should be scarified, moisture conditioned, and recompacted. A moderate tensile strength, woven geosynthetic (such as TerraTex HPG 37) should then be installed on the exposed subgrade in accordance with the manufacturer's recommendations. The excavation should then be returned to finished subgrade elevation with compacted and tested, structural fill.

It will be critical that a representative of CDG be present to evaluate the subgrade following undercutting or stabilization. Variations in the depth of required undercut and stabilization may be necessary based on the actual conditions encountered at the time of construction. Evaluation typically includes proofrolling with a loaded dump truck or other equipment capable of applying a high pressure. Unstable soils identified during the evaluation process should be moisture conditioned and re-compacted or removed and replaced with structural fill. Placement and compaction of structural fill may proceed following demonstration of a stable subgrade.

6.2 Plastic Clay Considerations

The soils encountered in the borings generally consisted of sandy lean clay, fat clay, or clayey sand. Based on laboratory testing results, the on-site fine-grained soils are moderately to highly plastic. Tested samples exhibited LL values ranging from 33 to 75 and PI values ranging from 19 to 51. Plastic soils exhibit a high potential for volume change with variations in moisture content. Soil volume changes can cause differential movement in overlying structures resulting in distress such as cracking of walls and ground-supported slabs.

The building, parking and drive areas should be protected from potential soil volume changes through the installation of a low-plasticity cap of structural fill. The fill should consist of off-site borrow composed of materials conforming to the requirements for structural fill detailed in this report. The cap should extend to a minimum depth of 24 inches below final subgrade elevation and continue to 5 feet horizontally beyond the building perimeters. **Undercut and replacement of existing undocumented fill as described in Section 6.1 is expected to satisfy the need for the low-plasticity cap without the need for additional remediation.**

6.3 Water Control

Groundwater was not encountered in the borings at the time of the field work. However, springs are often encountered in the geologic formations present at the site and perched groundwater may be present during the wetter months of the year. Therefore, it is possible that water seepage will be encountered during earthwork operations.

The volume of water encountered during grading is expected to vary based on recent precipitation levels. Therefore, the extent and method of dewatering will depend on the time of year earthwork is performed and can be determined in the field on a case-by-case basis. In general, water seepage present in excavations should be collected and removed from the site in a controlled manner with temporary sump pits and pumps or drainage ditches.

Permanent drains will be required in areas exhibiting continual seepage such as at the toe of cut slopes, in natural drainage swales, and where springs are encountered. The drain will serve to collect and remove water that continues to seep into the area and reduce the potential of water infiltrating the adjacent subgrade soils.

A typical trench drain should consist of a geosynthetic-lined trench, approximately 18 to 30 inches in width. The depth of the drain generally ranges from 24 to 36 inches and is determined based on field conditions. The geosynthetic should be a non-woven fabric designed for filtration (TerraTex SD or similar). A perforated drainpipe should be installed and the trench backfilled with free draining (less than 5% passing the #200 sieve), open-graded coarse aggregate (such as ASTM C-33 #57). The geotextile is then wrapped over the aggregate to completely enclose the drain.

6.4 Excavation Considerations

Earthwork at the site is assumed to include maximum excavation depths of approximately 5 to 6 feet. The borings encountered existing fill and terrace deposits to depths ranging from 17 to 21½ feet below the existing ground surface, at which depths the borings encountered refusal or were terminated. Existing fill and terrace deposits can typically be excavated using conventional earthmoving equipment in good working order.

Excavation should be done in such a way as to prevent loss of support to existing buildings within the development area. Temporary excavations should be a sufficient distance away from un-braced structures to prevent disturbance to the 45-degree wedge of soil extending down from the building's foundations. Excavations made closer to the existing buildings will require the use of shoring, bracing, or other support. Temporary excavations made adjacent to existing buildings should be properly backfilled the day of excavation to minimize the risk of disturbance.

The borings encountered soils containing significant fractions of coarse-grained materials (sand and rock fragments). Additionally, springs are frequently encountered in the geology underlying the site. Due to the presence of non-cohesive soils and the potential for groundwater, the sides of excavations may be unstable and likely to cave.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and floor. This report is not intended to address safety issues related to excavations. Job site safety and conformance to applicable codes and guidelines is solely the responsibility of the contractor.

6.5 Fill Placement

All material used as structural fill should be relatively free of debris, organics and other deleterious materials. In general, structural fill should exhibit a Liquid Limit less than 55, a Plasticity Index less than 30, and a maximum dry density of at least 100 pcf. Soil fill should contain no more than 30% rock, and individual rock fragments in the fill should be less than 3 inches in largest dimension. Soil fill must be placed in an environment free of excess water. Therefore, free-draining granular material (such as ASTM C-33 #57 coarse aggregate or clean sand with less than 5% passing the #200 sieve) should be used as the initial lift(s) of fill in areas containing water seepage.

Soil fill should be placed in lifts not exceeding eight inches in loose measure. Individual lifts of fill should be moisture conditioned to within -1% to +3% of the optimum moisture content and compacted to a minimum of 98% of the Standard Proctor (ASTM D-698) maximum dry density. Soil may require wetting or drying to achieve proper compaction. Thinner lifts and manually operated equipment will be required to achieve proper compaction in limited access areas (utility trenches, manholes, inlets).

Soil compaction testing should be performed during fill placement. Testing will give an indication of the contractor's performance with regard to soil density and moisture content requirements established in the project specifications. Compaction testing should be performed at random locations on each lift of fill placed to provide statistically relevant testing data. The frequency of density testing should be at least one test per lift for every 2,500 square feet of fill placed. Each lift of fill placed in utility trenches should be tested on 50-foot centers. A minimum of 3 tests should be performed on all lifts of structural fill.

6.6 Use of On-Site Soils as Structural Fill

Site grading and undercut of low-consistency materials will include excavation of existing undocumented fill. The undocumented fill exhibited a very poor consistency and contained debris and possible organics. Therefore, we recommend it be hauled off and not reused for the project.

6.7 Protection of the On-Site Soils

Tested, on-site soils contained a significant amount of fine-grained, silt and clay particles. Silt and clay tend to lose strength when exposed to excess moisture. Additionally, fine-grained soil can become soft and disturbed due to repeated trafficking and twisting or turning of wheeled construction equipment. Therefore, the on-site soils should be protected from surface water and construction disturbance.

Construction traffic should be controlled and routed so as to limit disturbance to the subgrade. Ponded water should not be allowed to remain on the soils. Additionally, it will be important that surface water from on and off the site be intercepted and diverted away from the proposed development. Installation of temporary construction ditches may be necessary to control the flow of surface water. Soils that become too wet or are disturbed should be moisture conditioned and re-compacted or removed and replaced with structural fill.

7.0 FOUNDATION RECOMMENDATIONS

The following foundation recommendations were developed based on evaluation of the boring and laboratory testing data and our experience with similar construction. As indicated previously, maximum column and wall loads were assumed to be less than 150 kips and 7.5 kips per linear foot, respectively. Grading plans were not available at the time of report preparation; however, based on review of available street level imagery and field observations, we have assumed that existing elevations will be within approximately 5 feet of proposed grades.

Based on the assumed grading and subsurface conditions encountered in the borings, it is our opinion that spread footings are an appropriate foundation alternative for foundation support of the proposed facility. However, undocumented fill in the building area should be undercut and replaced as previously described.

Following proper subgrade preparation, foundations are expected to bear on newly placed, compacted and tested, structural fill. Footings bearing on the noted materials may be designed based on an allowable bearing pressure of 2,500 psf. A value of 0.35 is recommended for the coefficient of friction between the bottom of the footing and the bearing materials. Continuous and column footings should have minimum widths of 18 and 24 inches, respectively. Footings should extend to a minimum depth of 24 inches below the lowest adjacent final subgrade elevation to provide confinement for the bearing soils.

Based on the recommendations above, total and differential settlements are expected to be less than approximately 1 inch and ½ inch, respectively. Foundations should be structurally isolated from ground-supported slabs to allow for differential movement associated with variable loading conditions. Alternatively, slabs should be jointed to prevent uncontrolled cracking at the interface with foundations. Based on International Building Code Guidelines, the development is assigned a seismic site class C.

Excavation for foundations often results in loosened or disturbed soils at the bearing elevation. Therefore, the bottom of footing trenches should be thoroughly compacted with a piston tamp following excavation. As previously described, water seepage may be encountered when making foundation excavations. Foundation concrete must be placed in a relatively dry excavation; therefore, temporary dewatering may be required.

A representative of CDG should observe all foundation excavations prior to concrete placement to determine if the exposed materials conform to the design requirements. Subgrade preparation as previously described is expected to remove any low-consistency soil from the proposed building area. However, should the engineer identify isolated zones of unsuitable material present at the proposed bearing elevation, the excavation should be extended to a suitable bearing stratum. Excavations may be returned to the original planned bearing elevation with lean concrete.

Foundation bearing materials judged acceptable by the Engineer should be protected from disturbance, freezing, and excessive wetting or drying. Therefore, the footing should be constructed the same day as the excavation is made and evaluated by the Engineer. If the contractor's schedule requires a delay between excavation and foundation construction, the bearing materials should be protected with a thin seal of lean concrete.

Following construction, the foundations and underlying soils should be isolated from sources of excess water. Grades adjacent to the structure should be adjusted so that surface water flows away from the foundations. In no case should water be allowed to pond over newly-constructed footings. Roof drains and downspouts should be directed away from the foundations. Additionally, soils adjacent to foundations should consist of properly compacted, structural fill to minimize water infiltration.

8.0 GROUND SUPPORTED SLABS

Provided the subgrade is prepared in accordance with our recommendations, the floor slabs can be supported on newly placed, structural fill compacted to the project requirements. Ground supported slabs may be designed based on a modulus of subgrade reaction of 125 pci.

The on-site soils contain fine-grained particles and may be sensitive to changes in moisture content. Soils that are wet and disturbed will lose strength and become unsuitable for slab support. Therefore, the contractor should exercise care when preparing the subgrade. Soils should be protected from disturbance caused by construction traffic. Water should not be allowed to pond on the subgrade nor should the soils be allowed to become excessively dry.

Once final subgrade elevation is established in the floor slab area, the exposed soils should be evaluated by a representative of CDG. Proofrolling with a loaded dump truck should be performed to compact the upper soils and identify areas of instability. Unsuitable material should be moisture conditioned and recompacted or removed and replaced with compacted, structural fill. Should the contractor's schedule delay floor slab construction after preparation of a suitable subgrade, the soils should be reevaluated immediately prior to concrete placement. Drying or wetting and recompaction of the soils will likely be required.

To reduce the potential for water migration through the floor slab, ground-supported slabs should be underlain by a capillary break consisting of a minimum of 4 inches of compacted, clean (<5% passing the #200 sieve), free-draining, granular material (such as ALDOT #57). Depending on the type of floor coverings to be used, the owner may also elect to install a vapor barrier typically consisting of 6-mil polyethylene sheeting. The sheeting will reduce the infiltration of water vapor through the slab and the potential for damage to floor coverings. However, we note that the use of a vapor barrier will increase the potential for plastic shrinkage cracking during curing of the concrete slab.

9.0 PAVEMENT SUBGRADE CONSIDERATIONS

The borings indicate the presence of undocumented fill soils throughout the site. Therefore, the subgrade should be prepared in accordance with Section 6 of this report. Proper subgrade preparation will be critical to provide support for the proposed pavements. Additionally, we recommended that materials and placement procedures for pavement construction conform to the Alabama Department of Transportation *Standard Specifications for Highway Construction*, latest edition.

The acceptable, long-term performance of pavements will be affected by many factors including traffic loading, the adequacy of the design section, construction techniques and materials, and weather patterns. Additionally, the condition of the subgrade materials immediately prior to placing pavements will impact the performance of the section. It is important that a high consistency and properly moisture conditioned subgrade be maintained prior to paving.

A representative of CDG should evaluate the subgrade immediately before the base course is placed. The evaluation will serve to identify unacceptable, near-surface soils that require reconditioning or removal and replacement. The subgrade should be protected from disturbance due to weather and construction traffic. It will be necessary to restore areas of the subgrade that become disturbed prior to pavement construction.

Flexible pavements will tend to rut in areas of static, heavy pressures. Therefore, we recommend that consideration be given to using Portland Cement Concrete (PCC) pavements where appropriate (truck drives and docking areas, drive-throughs, and dumpster areas, for example). PCC pavements will experience small changes in volume following placement. The volume change can lead to cracking in unreinforced slabs-on-grade. One of the most critical factors in the control of cracking is jointing. The American Concrete Paving Association typically recommends a joint spacing of 24 times the thickness of the concrete slab and a joint depth of ¼ of the slab thickness when using a granular base.

Properly designed and constructed pavement sections will gradually deteriorate with age. Typical deterioration includes cracking, color change, and brittle asphalt. Advanced aging characteristics include severe cracking, potholes, raveling, and rutting in areas of concentrated load. Therefore, all pavements require periodic maintenance to ensure suitable performance during their design life.

10.0 CONSTRUCTION PHASE SERVICES

We recommend that CDG be retained to provide engineering consultation and testing services during the construction phase of the project. Construction phase services typically include testing of materials such as soils and compacted fill, structural concrete, and steel. Additionally, engineering consultation and testing related to foundation construction and subgrade stabilization issues are typically provided.

A comprehensive testing program by the Geotechnical Engineer of Record is an essential element of the geotechnical evaluation for the project. Design assumptions were made based on widely spaced borings. Therefore, variations in soil properties should be expected and may only become apparent during construction. Testing and observation by the Engineer of Record is especially important during the earthwork and foundation phases of construction due to the high degree of variation in subsurface conditions typically present on a site and due to the presence of undocumented fill on this site specifically.

CDG cannot accept responsibility for the interpretation of the recommendations contained in this report nor for the application of the recommendations during construction of the project if not retained to provide a complete scope of construction observation and materials testing services.

11.0 GENERAL REMARKS AND CLOSING

This report has been prepared for the exclusive use of City of Gadsden for specific application to the proposed Gadsden City Hall project in Gadsden, Etowah County, Alabama. The recommendations in this report are intended for use on the stated project and should not be used for other purposes. It will be important for the Geotechnical Engineer of Record to review the final project plans and specifications to provide the appropriate interpretation of the recommendations contained in this report.

The conclusions, analyses, and recommendations presented in this report are based upon currently accepted engineering principles, practices, and existing testing standards in the area where the services were provided. No other warranty, expressed or implied, is made.

The recommendations in this report were developed based on our understanding of the proposed construction and from the limited information obtained from the field and laboratory testing programs. If significant changes are made in the scope of the project, CDG should be allowed to review our recommendations in light of the changes to determine if additional testing and revised conclusions are needed.

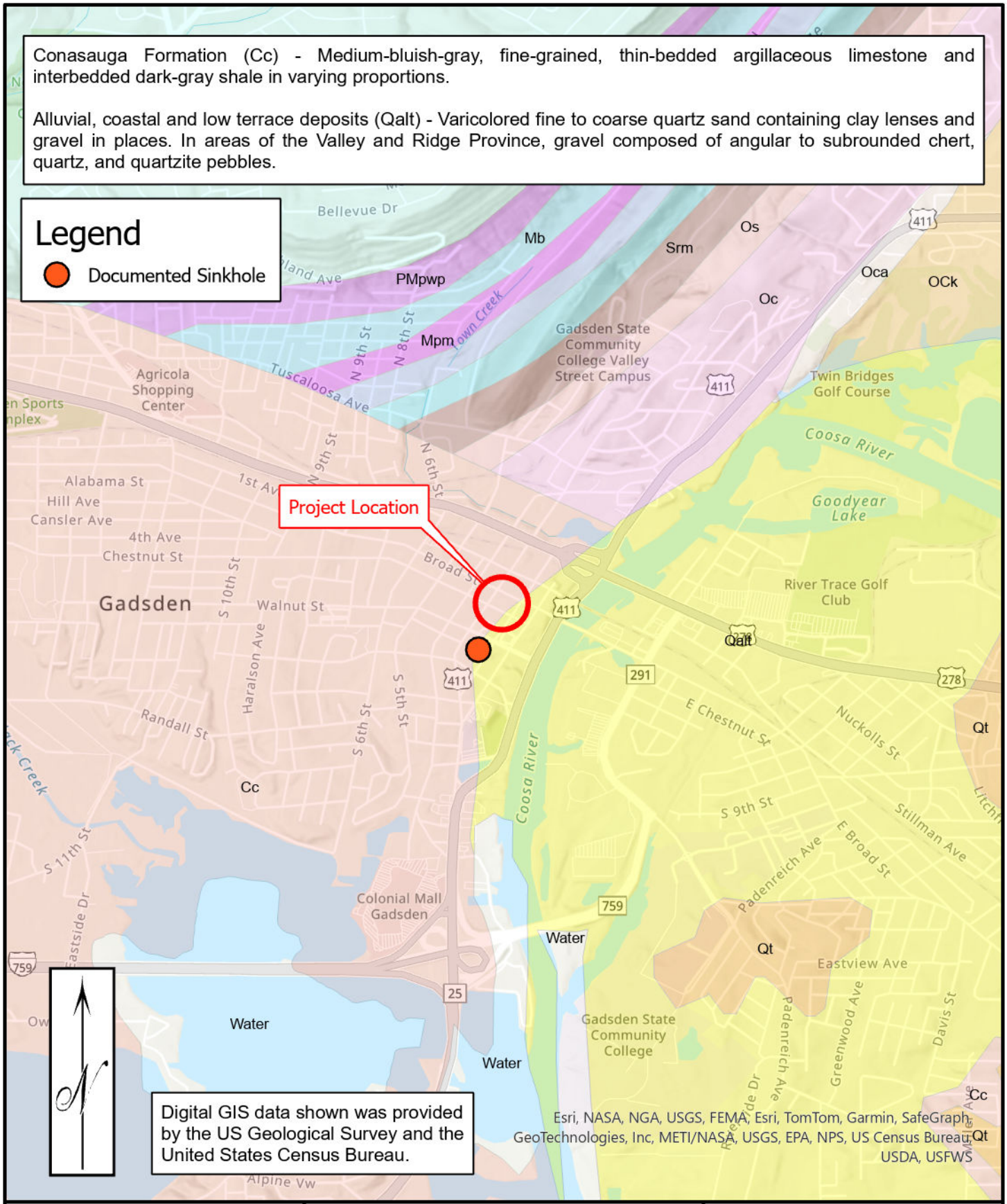
APPENDIX A

Project Maps

cdge.com

Conasauga Formation (Cc) - Medium-bluish-gray, fine-grained, thin-bedded argillaceous limestone and interbedded dark-gray shale in varying proportions.

Alluvial, coastal and low terrace deposits (Qalt) - Varicolored fine to coarse quartz sand containing clay lenses and gravel in places. In areas of the Valley and Ridge Province, gravel composed of angular to subrounded chert, quartz, and quartzite pebbles.

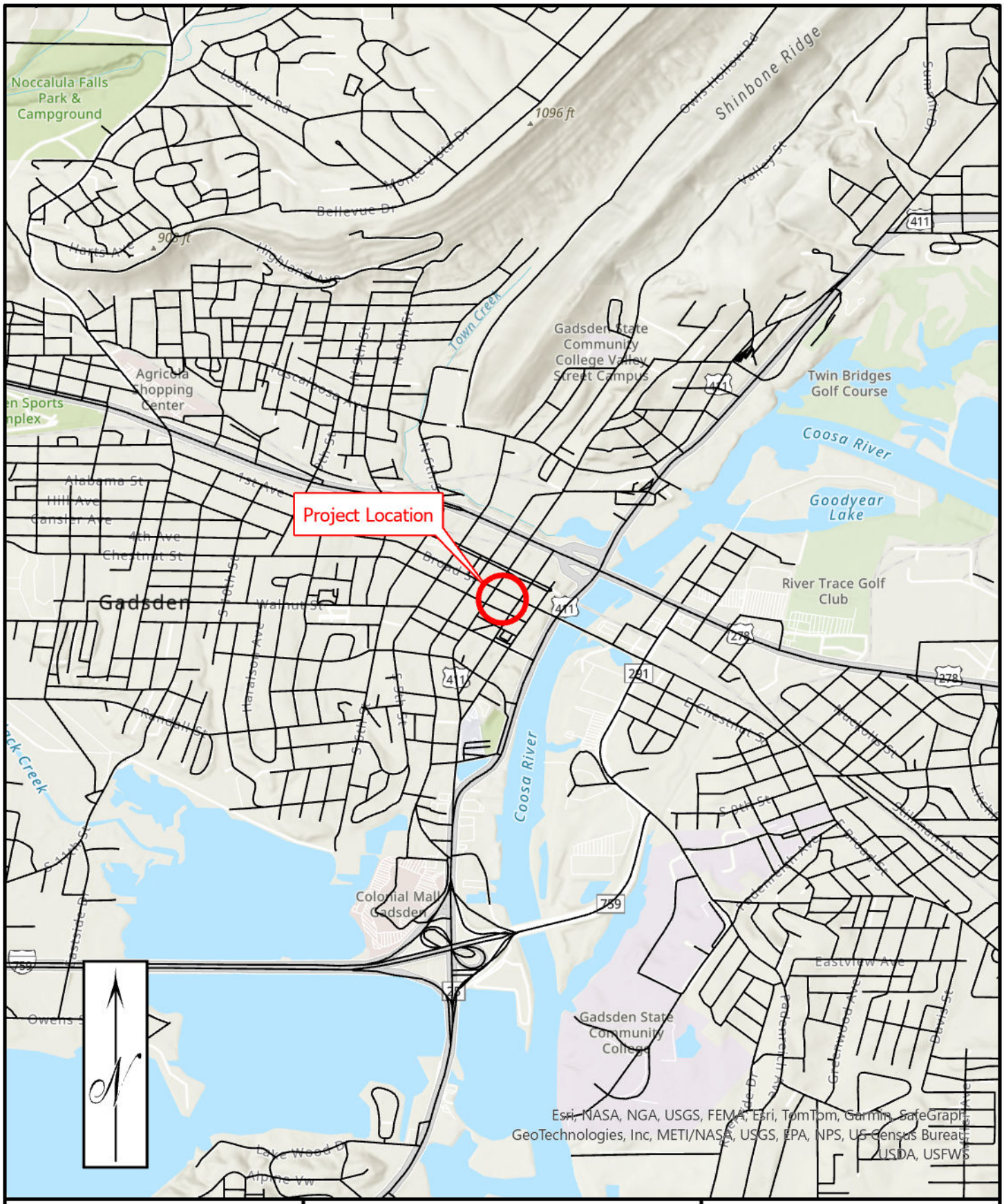


CDG

Site Geology & Documented Sinkhole Plan

Drawn By: CM	Scale: 1 in = 0.5 mi	Date: 10/25/2024

Gadsden City Hall
Gadsden, Alabama
CDG Project No. R628124011



CDG

Site Vicinity Map

Drawn By: CM	Scale: 1 in = 0.5 mi	Date: 10/2/2024

Gadsden City Hall
Gadsden, Alabama
CDG Project No. R628124011

APPENDIX B

Boring Location Plan

cdge.com

CDG

Boring Location Plan

Drawn By: CM	Scale: 1 in = 70 ft	Date: 10/9/2024

Gadsden City Hall
Gadsden, Alabama
CDG Project No. R628124011

APPENDIX C

Boring Logs

cdge.com

Boring ID: B-1

Gadsden City Hall

Project Number: R628124011	Ground Elevation: 552.5 ft	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01154	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00164	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		552.5	3 inches of concrete and 4 inches of gravel encountered at gound surface.												
0		0	**(Fill)**												
1															WOH = Weight of Hammer
2					WOH	WOH									No recovery
3		549.5 / 3	Very soft, light gray and tannish gray, lean CLAY with sand												
4					WOH	WOH				33	19	22	73	0.25	USCS = CL Sample emitted organic odor.
5		547													
6		5.5	**(Terrace Deposits)**												
7			Very stiff, orange and light gray, sandy, fat CLAY with subrounded rock and chert fragments		3-7-9	16						16		2.5	
8		544.5 / 8	...with increasing rock content		50/5	50+						8			N-value exaggerated by the presence of chert fragments within the sample interval.
9															
10															
11		540.75													
12		11.75	...medium, light brown												
13															
14					3-2-4	6						30			
15															
16															
17															
18		534.3 / 18.2	Auger refusal at a depth of 18.2 (ft).												No groundwater encountered at time of boring.
19															
20															
21															
22															
23															
24															
25															
26															

Boring ID: B-2

Gadsden City Hall

Project Number: R628124011	Ground Elevation: 551 ft	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01166	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00197	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		551	2 inches of asphalt and 6 inches of gravel encountered at gound surface.												
0		0	**(Fill)** Very soft, brown, fat CLAY with asphalt fragments		2-1-1	2						18		0.25	WOH = Weight of Hammer Sample emitted organic odor.
1															
2															
3		548 3	...same		WOH	WOH						19		0.25	
4															
5		545.5 5.5	**(Terrace Deposits)** Stiff, orange and light gray, fat CLAY with sand and chert fragments		4-4-6	10				50	33	20	82	1.75	USCS = CH
6															
7															
8		543 8	...very stiff		6-12-16	28						14		3.0	
9															
10															
11		539.25 11.75	...soft, with sand and trace chert fragments		3-2-2	4						21		0.5	
12															
13															
14															
15															
16															
17		533.8 17.2	Auger refusal at a depth of 17.2 (ft).												No groundwater encountered at time of boring.
18															
19															
20															
21															
22															
23															
24															
25															
26															

Boring ID: B-3

Gadsden City Hall

Project Number: R628124011	Ground Elevation:	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01183	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00186	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	2 inches of asphalt and 8 inches of gravel encountered at ground surface.												
0		0	**(Fill)** Medium, brown, silty CLAY with trace subrounded rock fragments		3-3-3	6								0.5	WOH = Weight of Hammer
1															
2															
		-3													
3		3	...soft, with subrounded rock fragments		WOH-3-4	7								0.25	
4															
5		-5.5													
		5.5	**(Terrace Deposits)** Very stiff, orange and light gray, sandy, fat CLAY with trace chert fragments		5-7-14	21								3.5	
6															
7		-8													
		8	...orange, with numerous chert fragments		15-50/5	50+								3.5	N-value exaggerated by the presence of chert fragments within the sample interval.
8															
9															
10															
11		-11.75													
		11.75	Loose, light gray, clayey SAND		3-2-3	5									
12															
13															
14															
15															
16		-16.75													
		16.75	**(Conasauga Formation)** DECOMPOSED LIMESTONE: sampled as white and light gray, sandy clay with rock fragments		50/2	50+									
17															
18		-18.9													
		18.9	Auger refusal at a depth of 18.9 (ft).												No groundwater encountered at time of boring.
19															
20															
21															
22															
23															
24															
25															
26															

Boring ID: B-4

Gadsden City Hall

Project Number: R628124011	Ground Elevation: 552 ft	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01176	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00166	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		552	12 inches of concrete and 6 inches of gravel encountered at ground surface.												
0		0	**(Fill)** Very soft, brown, gray, and orange, silty CLAY with sand		WOH-2	2						16			WOH = Weight of Hammer
5		546.5 / 5.5	**(Terrace Deposits)** Stiff, orange and light gray, fat CLAY with trace chert fragments		3-5-7	12				75	51	18		2.75	USCS = CH
8		544 / 8	...hard, with chert fragments		6-17-50/1	50+						14		>4.0	
12		540.25 / 11.75	Loose, brown, clayey, fine to medium SAND		3-4-5	9				53	27	29	45	1.25	USCS = SC
17		535.25 / 16.75	**(Conasauga Formation)** DECOMPOSED LIMESTONE: sampled as white and light gray, sandy silt with rock fragments		50/6	50+						11			
20		532.7 / 19.3	Auger refusal at a depth of 19.3 (ft).												No groundwater encountered at time of boring.

Boring ID: B-5

Gadsden City Hall

Project Number: R628124011	Ground Elevation: 552 ft	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01176	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00151	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		552	12 inches of concrete and 6 inches of gravel encountered at ground surface.												
0		0	**(Fill)** Very soft, brown, gray, and orange, silty CLAY with sand		WOH-2	2								0.5	WOH = Weight of Hammer
5		546.5 / 5.5	**(Terrace Deposits)** Very stiff, orange and light gray, fat CLAY with chert fragments		4-10-12	22								3.5	
8		544 / 8	...stiff, light gray		5-6-7	13									Limited recovery
12		540.25 / 11.75	Loose, tan and gray, clayey SAND		3-3-3	6									
17		535.25 / 16.75	**(Conasauga Formation)** DECOMPOSED LIMESTONE: sampled as gray, sandy clay with rock fragments		50/4	50+									
21		531.4 / 20.6	Auger refusal at a depth of 20.6 (ft).												No groundwater encountered at time of boring.

Boring ID: B-6

Gadsden City Hall

Project Number: R628124011	Ground Elevation: 551.5 ft	Method: Diedrich D-50
Project Location: Gadsden, Alabama	Latitude: 34.01194	Logged By: J. Outland
Date Started: 09-30-2024	Longitude: -86.00175	Hammer Efficiency: 86
Date Completed: 09-30-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		551.5	2 inches of asphalt and 8 inches of gravel encountered at ground surface.												
0		0	**(Fill)** Stiff, grayish-brown CLAY with sand and slag fragments		4-6-4	10								1.75	
1															
2															
		548.5													
3		3	...soft												
4					2-2-2	4									No recovery
5		546													
		5.5	**(Terrace Deposits)** Very stiff, orange and light gray, sandy, fat CLAY with chert fragments												
6					4-8-12	20								4.0	
7															
		543.5													
8		8	...stiff, trace chert fragments												
9					5-4-6	10									
10															
11															
		539.75													
12		11.75	Medium dense, light gray, clayey SAND with chert fragments												
13															
14					5-6-7	13									
15															
16															
		534.75													
17		16.75	**(Conasauga Formation)** DECOMPOSED SHALE: sampled as dark gray, sandy clay												
18															
19					12-18-50/3	50+									
		531.5													
20		20	Boring terminated at a depth of 20 (ft).												No groundwater encountered at time of boring.
21															
22															
23															
24															
25															
26															

APPENDIX D

Laboratory Test Results

cdge.com

Soil Classification Results

Huntsville
6767 Old Madison Pike
Suite 400
Huntsville, AL 35806
Phone: 256-539-7470

Client:

City of Gadsden
90 Broad Street
Gadsden, AL 35901

Project:

R628124011
Gadsden City Hall
224 Broad St
Gadsden, AL

Sample and Test Information

Boring No. / Sample #: B - 1 / 7724

Location Details: B-1 ; 3.5' - 5.0'

Sample Depth (ft.): 3.5' - 5.0'

Sample Description:
Light gray and tan, lean CLAY with fine sand

Date Sampled: 09/30/2024 **Date Tested:** 10/23/2024

Completed By: Trey Tuck **Date Issued:**

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 33

Plastic Limit (PL): 14

Plasticity Index (PI): 19

Classifications

AASHTO : A-6

USCS: CL

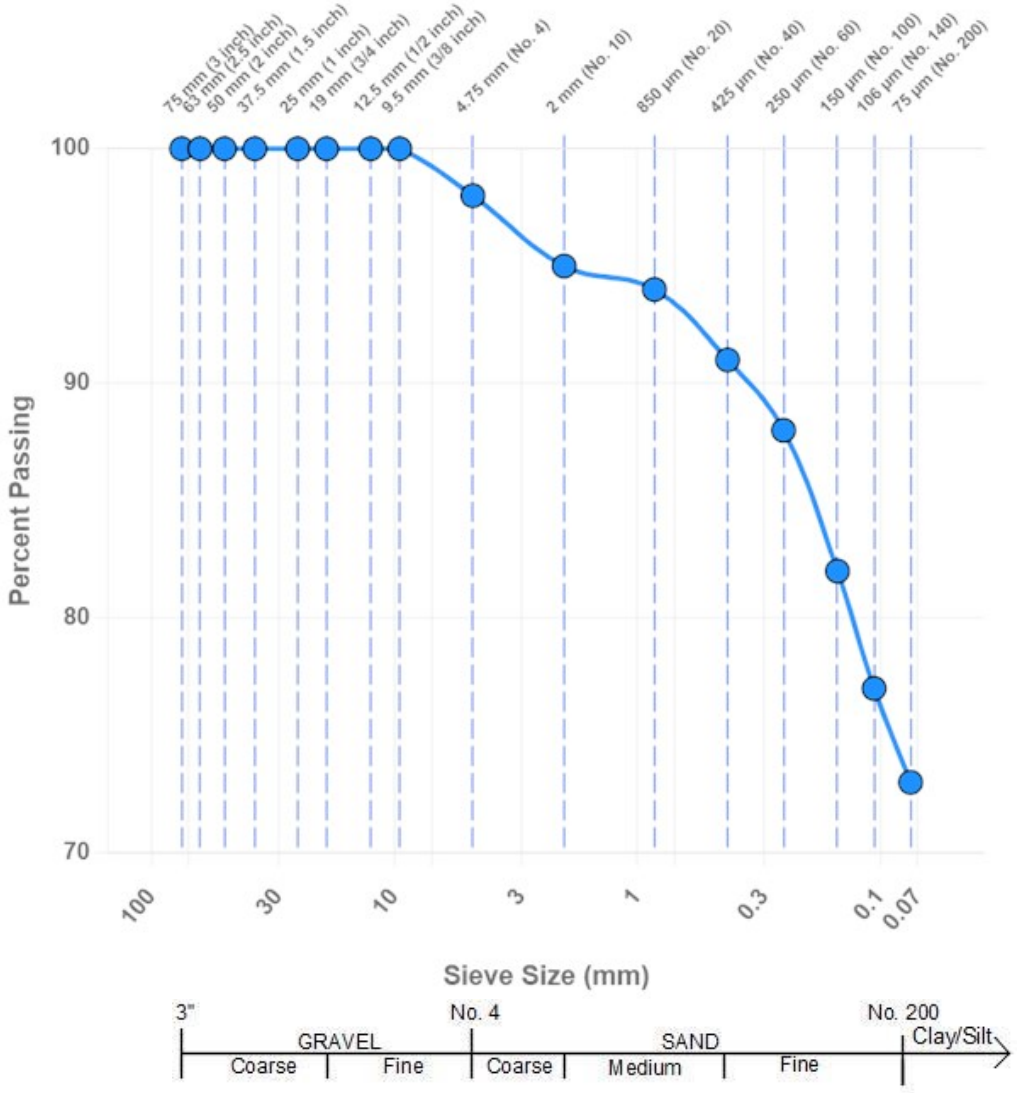
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 2.0

Percent Sand: 25.0

Percent Clay/Silt: 73.0

Soak Duration: 24 hours



Soil Classification Results

Huntsville
6767 Old Madison Pike
Suite 400
Huntsville, AL 35806
Phone: 256-539-7470

Client:

City of Gadsden
90 Broad Street
Gadsden, AL 35901

Project:

R628124011
Gadsden City Hall
224 Broad St
Gadsden, AL

Sample and Test Information

Boring No. / Sample #: B - 2 / 7730

Location Details: B-2; 6.0' - 7.5'

Sample Depth (ft.): 6.0' - 7.5'

Sample Description:
Orange and light gray, fat CLAY with fine sand

Date Sampled: 09/30/2024 **Date Tested:** 10/23/2024

Completed By: Trey Tuck **Date Issued:**

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 50

Plastic Limit (PL): 17

Plasticity Index (PI): 33

Classifications

AASHTO : A-7-6

USCS: CH

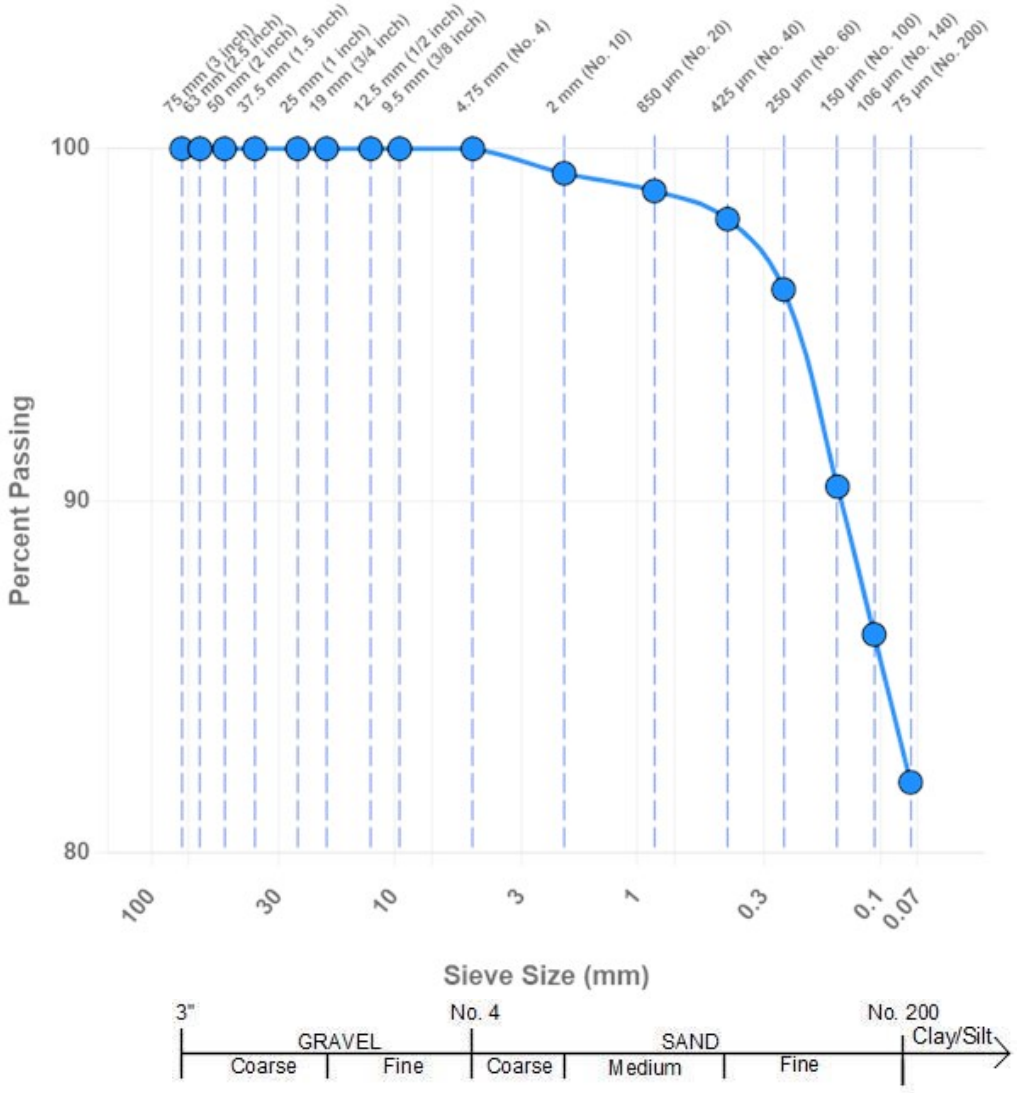
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 0.0

Percent Sand: 18.0

Percent Clay/Silt: 82.0

Soak Duration: 24 hours



Soil Classification Results

Huntsville
6767 Old Madison Pike
Suite 400
Huntsville, AL 35806
Phone: 256-539-7470

Client:

City of Gadsden
90 Broad Street
Gadsden, AL 35901

Project:

R628124011
Gadsden City Hall
224 Broad St
Gadsden, AL

Sample and Test Information

Boring No. / Sample #: B - 4 / 7734

Location Details: B-4; 6.0' - 7.5'

Sample Depth (ft.): 6.0' - 7.5'

Sample Description: Orange and light gray, fat CLAY

Date Sampled: 09/30/2024 **Date Tested:** 10/23/2024

Completed By: Trey Tuck **Date Issued:**

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 75

Plastic Limit (PL): 24

Plasticity Index (PI): 51

Classifications

Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 100.0

Percent Sand: 0.0

Percent Clay/Silt: 0.0

Soak Duration: hours

Soil Classification Results

Huntsville
6767 Old Madison Pike
Suite 400
Huntsville, AL 35806
Phone: 256-539-7470

Client:

City of Gadsden
90 Broad Street
Gadsden, AL 35901

Project:

R628124011
Gadsden City Hall
224 Broad St
Gadsden, AL

Sample and Test Information

Boring No. / Sample #: B - 4 / 7736

Location Details: B-4; 13.5' - 15.0'

Sample Depth (ft.): 13.5' - 15.0'

Sample Description: Brown clayey, medium to fine, SAND

Date Sampled: 09/30/2024 **Date Tested:** 10/23/2024

Completed By: Trey Tuck **Date Issued:** 10/23/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 53

Plastic Limit (PL): 26

Plasticity Index (PI): 27

Classifications

AASHTO : A-7-6

USCS: SC

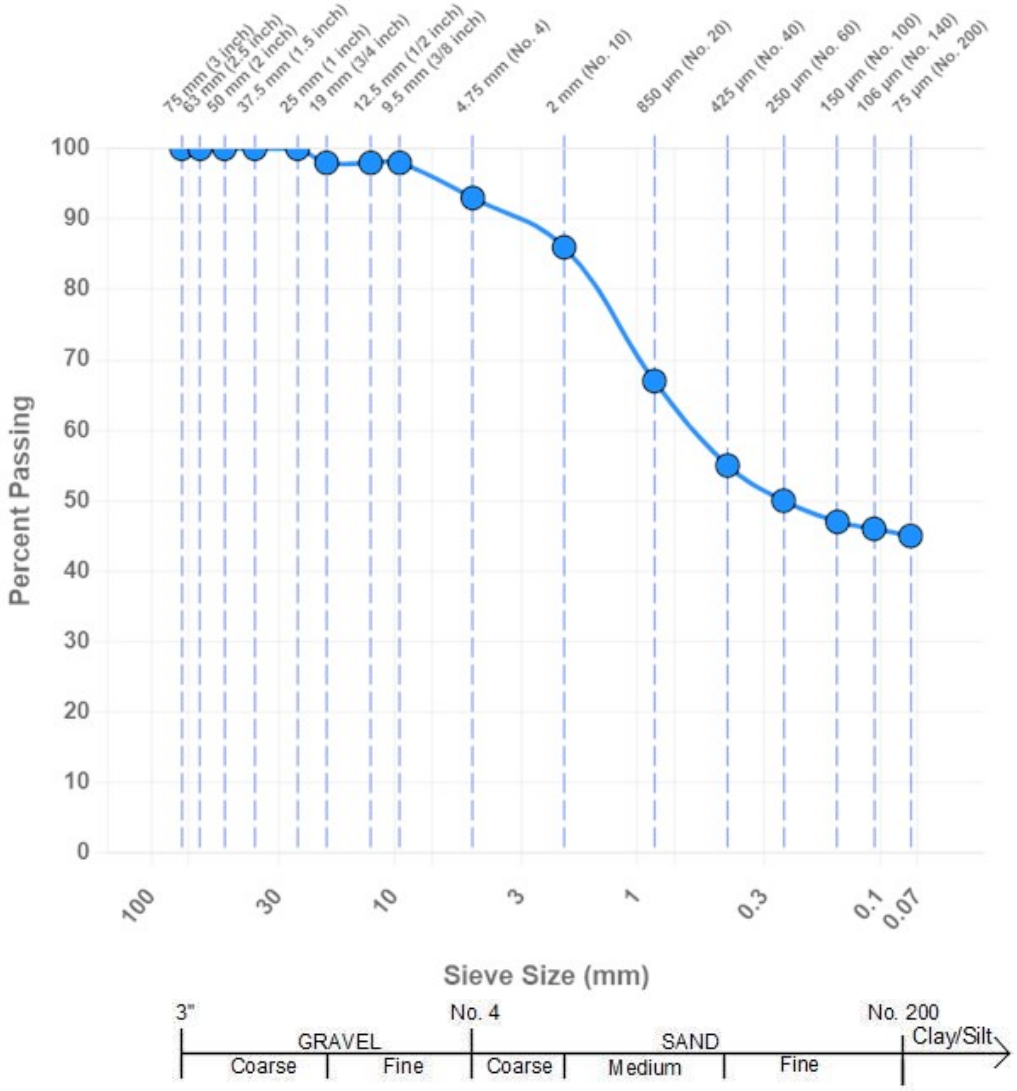
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 7.0

Percent Sand: 48.0

Percent Clay/Silt: 45.0

Soak Duration: 24 hours



Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSULTANTS | DESIGNERS | GUIDES

SECTION 00 6102

INSTRUCTIONS TO BIDDERS

SECTION INCLUDES THE FOLLOWING:

102.1 PROPOSALS

a. All bidders must be registered with the City of Gadsden Engineering Department in order to submit a bid. Bids received from unregistered bidders will be rejected.

b. All bids shall be submitted on forms prepared by the Owner, and shall be subject to all requirements of the Standard Specifications, project drawings and the instructions to prospective bidders. In the event of a unit price contract, the Engineering Department will check the extension of each item given in the proposal and correct all errors or discrepancies. In case of an error in the extension of prices, the unit price shall govern. The total amount obtained by adding all of the products of the unit prices and the various estimated quantities listed in the proposal shall be the Contract bid price. The unit prices shall be in ink or typed, and any alteration or erasure on the bid proposal shall be initialed by the signer.

c. The proposal shall be properly signed by the bidder and the bid documents enclosed in an envelope, which shall be sealed and clearly labeled with the words, "BID DOCUMENTS", the PROJECT NAME, the Gadsden BID NUMBER, the NAME AND ADDRESS OF THE BIDDER, and the BIDDER'S STATE OF ALABAMA CONTRACTOR'S LICENSE NUMBER. Any bids not so marked on the envelope with the contractor's license number will not be opened. The date and time for receiving bids should be shown on the envelope to guard against the premature opening of any bid.

d. The Owner may not consider any bid which is not submitted on a bid form supplied by the Engineering Department, or altered in any way.

e. The Contract shall be awarded based upon the completion of the work according to the Specifications and drawings, together with all addenda thereto, of the lowest responsive proposal submitted by a responsible contractor. The Owner reserves the right to waive any informalities or reject any and all bids. The bidder is required to submit only his lowest proposal for the work to be performed.

102.2 INTERPRETATIONS

No oral interpretation will be made to any bidder as to the meaning of the Specifications including the drawings. Every request for such an interpretation shall be made in writing to the owner at the address shown in the Invitation for Bids. Any inquiry received four (4) or more days prior to the date fixed for

opening of bids will be given consideration. Every interpretation made to a bidder will be in the form of an addendum to the specifications which, if issued, will be on file in the office of the City Engineer of the City of Gadsden, Alabama until such time that the bids are opened. In addition, addenda will be submitted to the email on file for each bidder, but it shall be the bidder's responsibility to make inquiry as to addenda issued. All such addenda shall become part of the Contract and all bidders shall be bound by such addenda, whether or not received by the bidders.

102.3 ALTERNATE BIDS

The bid contains no alternates.

102.4 BID SECURITY

a. The bid must be accompanied by a bid guaranty which shall be equal to the lesser of five percent (5%) of the amount of the bid or ten thousand dollars ($10,000), and at the option of the bidder, may be a cashiers check or a bid bond secured by a guaranty company or a surety company in the form attached. No bid will be considered unless it is so guaranteed. Cashiers checks must be made payable to the order of the Owner. Cash deposits will not be accepted. The bid guaranty shall insure the execution of the contract and the furnishing of performance and payment bond or bonds by the successful bidder all as required by the Specifications.

b. In case bid security is in the form of a cashiers check, the Owner may take such disposition of the same as will accomplish the purpose for which submitted. Cashiers checks of unsuccessful bidders will be returned as soon as practicable after the opening of bids.

102.5 COLLUSIVE AGREEMENTS

a. Each person submitting to the Owner a bid for any portion of the work contemplated by the bidding documents shall execute an affidavit in the form herein provided, to the effect that he has not colluded with any other person, firm or corporation in regard to any bid submitted. Such affidavit shall be attached to the bid.

b. Each person submitting a bid for any subcontractor work shall submit to the contractor an affidavit in the form provided in Division 105.

c. Failure on the part of any bidder for either the prime contract or subcontracts to observe these provisions shall be cause for rejection of his bid.

102.6 CORRECTIONS

Erasures or alterations in the unit prices or other items of the proposal must be initialed by the bidder.

102.7 TIME FOR RECEIVING BIDS

a. Bids received prior to the time of opening will be securely kept, unopened. The officer whose duty it is to open them will decide when the specified time has arrived, and no bid received thereafter will be considered. No responsibility will be attached to an officer for premature opening of a bid not properly addressed or identified. This type of bid may not be considered.

b. Bidders are cautioned to allow ample time for transmittal of bids by mail or otherwise. Bidders should secure correct information relative to the probable time of arrival and distribution of mail at the place where bids are to be opened.

102.8 OPENING OF BIDS

At the time and place fixed for the opening of bids, every bid received within the time fixed for receiving bids will be opened and publicly read aloud, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.

102.9 WITHDRAWAL OF BIDS

Bids may be withdrawn on written request dispatched by the bidder in time for delivery in the normal course of business prior to the time fixed for opening, provided that written confirmation of such withdrawal over the signature of the bidder is received by the bid officer prior to the time set for bid opening. Negligence on the part of the bidder in preparing his bid confers no right of withdrawal or modification of his bid after such bid has been opened. No proposal can be withdrawn, modified, or corrected after the hour set for opening the bids.

102.10 AWARD OF CONTRACT; REJECTION OF BIDS

a. The Contract will be awarded to the responsible bidder submitting the lowest proposal complying with the conditions of the Invitation for bids provided his bid is reasonable and it is to the interest of the owner to accept it. The bidder to whom the award is made will be notified at the earliest practicable date. The Owner, however, reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the Owner.

b. The Owner also reserves the right to reject the bid of any bidder who has previously failed to perform properly, or to complete contracts on time, who is not in a position to perform the contract, or who has disregarded his obligations to subcontractors, material men or employees. In determining the lowest responsible bidder, the following elements, in addition to those mentioned above, will be considered; whether the bidder involved (1) maintains a permanent place of business; (2) has adequate plant equipment available to do the work properly and expeditiously; (3) has suitable financial resources to meet the obligations incident to the work; (4) has appropriate technical experience; (5) has defaulted under previous contracts; (6) has failed to pay or settle bills due for labor and material on former contracts in force at the time of issuance of proposals.

c. The ability of a bidder to obtain a performance bond shall not be regarded as the sole test of such bidder's competency or responsibility.

102.12 PERFORMANCE BONDS AND LABOR AND MATERIAL BOND, EXECUTION OF CONTRACT

a. Subsequent to the award, the successful bidder shall execute and deliver to the Owner a contract in the form included in the specifications in such a number of counterparts as the Owner may require. The contract shall be delivered to the Owner within the time limit specified, not to exceed ten (10) days after the instrument is submitted to the contractor for signature. Separate contract forms, in lieu of those found in these specifications, shall be used for submittal to the Owner.

b. After satisfying all conditions required for awarding the contract, as set forth in these documents, the successful bidder shall, within ten days, furnish a Performance Bond on the form included in the proposal in an amount equal to one hundred percent (100%) of the contract bid price of the contract as awarded. The successful bidder shall also furnish a Labor and Material Bond in an amount not less than 100% of the contract bid price, with the obligation that the contractor shall within ten days make payment to all persons, firms or corporations to whom the contractor may become legally indebted for labor, materials, services and equipment used in the prosecution of the work, or for the payment of reasonable attorney's fees incurred by successful claimants or plaintiffs in suits on said bonds.

c. The failure of the successful bidder to properly execute the Contract and to supply the required bonds in accordance with the requirements of Section 102.12 a., b., and c shall constitute a default, and the Owner may, at its pleasure, award the Contract to the next responsible bidder or re-advertise for bids; and may charge against the initial bidder the difference between the amount bid and the amount for which a contract for the identical work is subsequently execute.

SECTION 00 6103

BID SPECIFICATIONS

CHECKLIST FOR REQUIRED DOCUMENTS TO BE SUBMITTED AT BID

- ❒ BID FORM
- ❒ BID BOND
- ❒ NON-COLLUSION AFFIDAVIT OF PRIME BIDDER
- ❒ EQUAL OPPORTUNITY REPORT STATEMENT
- ❒ CONTRACTOR'S CERTIFICATION OF NONSEGREGATED FACILITIES

These documents shall be included and executed properly in the bid package or the bid submitted will not be considered by the awarding authority.

_____

Company Name
(Please Print Or Type)

BID FORM

BID NO. 3580 FOR THE CONSTRUCTION OF GADSDEN CITY HALL FOR THE CITY OF GADSDEN, ALABAMA. THE PROJECT SHALL BE BID IN ACCORDANCE WITH THE PROJECT PLANS.

TO: The City of Gadsden
P.O. Box 267
City Hall
Gadsden, Alabama
Attn: City Clerk

City Officials:

103.1 The undersigned, having examined and become familiar with the local conditions affecting the cost of the work and with the Specifications (including Invitations for Bids, Instructions to Bidders, This Bid, the Form of Bid Bond, Statements of Bidder's Qualifications and Form of Contract, the Form of Non-Collusion Affidavit, the Form of Performance Bond and Labor and Material Bond and the Technical Specifications) and addenda numbered _____ to _____, as prepared by Williams Blackstock Architects, and on file in the office of the Director of Engineering of the City of Gadsden, Alabama, The City Hall, Gadsden, Alabama, hereby proposes to furnish all labor, materials, equipment, and services required to construct and complete "GADSDEN CITY HALL". Due to the nature of work on this project, all items of work will be let in one contract or as separate proposals, whichever is applicable.

_____

Company Name
(Please Print Or Type)

In submitting this bid, it is understood that the right is reserved by the City of Gadsden, Alabama to reject any and all bids. If written Notice of Acceptance of this bid is mailed to the undersigned within sixty (60) days after the opening thereof, or any time thereafter before this bid is withdrawn, the undersigned agrees to execute and deliver a contract in the prescribed form and furnish the required bonds within ten (10) days after the contract is presented to him for signature.

103.3 Security in the sum of

_____, Dollars ($_____)

in the form of _____ is submitted herewith in accordance with the

specifications.

103.4 Attached hereto is an affidavit that the undersigned has not entered into any collusion with any person in respect to this proposal or any other proposal or the submitting of proposal for the contract for which this proposal is submitted. Also attached is a statement of bidder's qualifications.

Date:_____ _____
Contractor

OFFICIAL ADDRESS

_____ By:_____

_____ Title:_____

Ala. License No._____

Federal Tax ID No._____

Phone No._____

Fax No._____

_____
Company Name
(Please Print Or Type)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we the Undersigned

_____

__

as PRINCIPAL, and _____, as SURETY are held and firmly bound unto the City of Gadsden, Alabama herein-after called the "City of Gadsden", in the penal sum of_____

_____Dollars lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, That whereas the principal has submitted the accompanying bid, dated_____, 20____, for_____

_____

NOW THEREFORE, if the Principal shall not withdraw said bid after the opening of the same, and shall within the period after the prescribed forms are presented to him for signature, enter into a written contract with the City of Gadsden in accordance with the bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract; or in the event of the failure to enter into such contract and given such bond within the time specified, if the Principal shall pay the City of Gadsden, the difference between the amount specified in said bid and the amount for which the City of Gadsden may procure the required work or supplies or both, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____day of_____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

IN PRESENCE OF:

_____ _____(SEAL)
Individual Principal

_____ _____
Business Address

_____ _____(SEAL)
Individual Principal

_____ _____
Business Address

_____
Company Name
(Please Print Or Type)

Attest:

_____ _____
Corporate Principal

_____
Business Address

By_____(SEAL)*

Attest:

_____ _____
Corporate Surety

_____
Business Address

By_____(SEAL)*

(Power of Attorney for person signing for surety company must be attached to bond.)

*Affix corporate seals.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____of the corporation named as Principal in the within bond; that _____, who signed the said bond on behalf of the Principal was then _____ of said corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested to for and in behalf of said corporation by authority of its governing body.

_____(SEAL)*

_____
Company Name
(Please Print Or Type)

STATEMENT OF BIDDER'S QUALIFICATIONS

(General Contractor)

All questions must be answered and the date given must be clear and comprehensive. This statement must be notarized. **This information shall be submitted prior to award (if requested)**.

1. Name of bidder.
2. State License #
3. Permanent main office address.
4. When organized.
5. Where incorporated.
6. How many years have you been engaged in the contracting business under your present firm name?
7.* Contracts on hand: (Schedule these, showing gross amount of each contract and the approximate anticipated dates of completion.)
8.* General character of work performed by your company.
9. Have you ever failed to complete any work awarded to you? Please explain.
10.* Have you ever defaulted on a contract? Please explain.
11.* List the projects completed by your company within the last two years stating approximate cost for each, and the month and year completed.
12.* List your major equipment to be used on this contract.
13.* Background and experience of the principal members of your personnel, including the officers.
14.* Credit available; furnish written evidence.
15. Proof of enrollment in the E-Verify system.

*If necessary, attach separate sheets for these items.

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

STATE OF _____

COUNTY OF _____

_____, being first duly sworn, deposes and says that:

(5) He is _____of _____
(Owner or Partner or Officer) (Firm)

_____, The Bidder that has submitted the attached Bid;

(5) He is fully informed respecting the preparation and contents of the attached Bid and of all circumstances respecting such Bid;

(6) Such Bid is genuine and is not collusive or sham Bid;

(5) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed directly or indirectly with any other Bidder, firm or person to submit a collusive or sham bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Local Authority or any person interested in the proposed Contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

_____
(Name of bidder if the bidder is an individual)
(Name of Partner is the bidder is a Partnership)
(Name of Officer if the bidder is a Corporation)

Subscribed and sworn to before me
this _____ day of _____, _____

(Notary Public)_____
My Commission Expires _____, _____

EQUAL OPPORTUNITY REPORT STATEMENT

The Bidder (Proposer) shall complete the following statement by checking the appropriate boxes.

* The Bidder (Proposer) has ____ has not ____ participated in a previous contract subject to the equal opportunity clause prescribed by Executive Order 10925, or Executive Order 11246.

* The Bidder (Proposer) has ____ has not ____ submitted all compliance reports in connection with any such contract due under the applicable filing requirements; and that representatives indicating submission of required compliance reports signed by proposed sub-contractors will be obtained prior to award of subcontracts.

If the Bidder (Proposer) has participated in a previous contract subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, the Bidder (Proposer) shall submit a compliance report on Standard Form 100, "Employee Information Report EEO-1, Prior to the award of contract.

*NOTE: Failure to complete these blanks may be grounds for rejecting bid.

_____
Name of Bidders

By_____

Title_____

Business Address:_____

_____

Contractor's License No._____

WAGE, LABOR, AND EQUAL EMPLOYMENT OPPORTUNITY

CONTRACTORS CERTIFICATION OF NONSEGREGATED FACILITIES

It is hereby certified as a contractor on federally assisted projects that segregated facilities are not maintained or provided for company employees and employees are not permitted to perform their services at any location, under company control, where segregated facilities are maintained. It is agreed that a breach of this certification is a violation of the equal opportunity clause of this contract. As used in this specification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants, and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are, in fact segregated on the basis of race, color, religion, sex, or national origin because of habit, local custom or any other reason. It is agreed further that identical certifications will be obtained from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the equal opportunity clause, and that these certifications will be retained in the company files.

_____ _____

Signature Date:

CONTRACT

THIS AGREEMENT made this the _____, day of _____, 2024, by and between _____, herein called the "Contractor" and the City of Gadsden, Alabama, a Municipal Corporation, hereinafter called the "Owner".

WITNESSETH: That the Contractor and the Owner for the consideration stated herein mutually agree as follows:

ARTICLE 1. Statement of Work. The Contractor shall furnish all labor, materials, equipment, and services and perform and complete all work required for this project in accordance with the specifications entitled:

SPECIFICATIONS & CONTRACT DOCUMENTS
GADSDEN CITY HALL
BID REQUEST NO. 3580
DECEMBER 17, 2024

and Addenda thereto numbered __ to __ which said Specifications, Addenda, are incorporated herein by reference and made a part thereof.

ARTICLE 2. The Contract Price. The Owner shall pay the Contractor for the performance of the contract based on the actual quantities of work completed or material furnished in accordance with the prices shown in the following Schedule of Prices, in current funds, subject to additions and deletions as provided in the Specifications.

TOTAL CONTRACT PRICE $_____

ARTICLE 3. Contract Documents. The Contract shall consist of the following component parts.

a. This Instrument
b. General Conditions
c. Special Conditions
d. General Scope of Work
e. Technical Specifications
g. Bid Documents

This instrument, together with the other documents enumerated in this Article which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, forms the contract. In the event that any provision in any component part of this contract conflicts with any provision of any other component, the provision of the component part first enumerated in this Article 3 shall govern, except as otherwise specially stated. The various provisions in Addenda shall be construed in the order of preference of the component part of the contract which each modifies.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed in four original counterparts the day and year first above written.

_____
Contractor

WITNESS
_____ By_____

_____ Title_____

Address_____

_____

THE CITY OF GADSDEN, ALABAMA

WITNESS
_____ _____
Craig Ford, Mayor

_____

CERTIFICATIONS

I, _____, certify that I am the _____

of the corporation named as Contractor herein; that _____, who signed this Contract on behalf of the Contractor was then _____, of said Corporation, that said Contract was duly signed for and in behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

_____(SEAL)*

_____

_____

I, hereby certify that, Craig Ford, Mayor of the City of Gadsden, Alabama is the duly elected qualified official who is authorized by the City of Gadsden, Alabama to execute this contract in the name of the City of Gadsden, Alabama.

_____(SEAL)*
Iva Nelson, City Clerk

(Print or type the names underneath all signatures.)

*(Affix corporate seal where marked (SEAL).

STATE OF ALABAMA
COUNTY OF ETOWAH

I,_____, a Notary Public in and for said County in said State, hereby certify that _____ whose name as _____ of _____, a corporation, is signed to the foregoing instrument and who is known to me, acknowledged before me on this day that, being informed of the contents of the instrument, he, in his capacity as such _____ executed the same voluntarily for and as the act of said corporation, on the day the same bears date.

Given under my hand on _____, 2024.

_____

Notary Public

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, That we_____

_____

hereinafter called the Principal, and _____

_____

hereinafter called the surety, are held and firmly bound unto the City of Gadsden, Alabama, a municipal corporation, for use of the City of Gadsden and all persons doing work or furnishing skill, tools, machinery, supplies or materials under or for the purpose of the contract hereinafter referred to, in the full and just sum of _____

_____

($_____) in lawful money of the United States of America to be paid to the City of Gadsden, its successors and assigns to which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a contract with the City of Gadsden, dated _____, 2024 for _____

_____

all in strict accordance with the Pictures, Specifications, and other documents relating thereto; and

WHEREAS, it was one of the conditions of the award by the City of Gadsden, pursuant to which the contract hereinabove referred to was entered into, that these presents shall be executed:

NOW, THEREFORE, the conditions of this obligation are such that the Principal shall in all respects fully comply with the terms and conditions of said contract and his obligations thereunder, including the specifications and proposals therein referred to and made a part thereof and such alterations as may be made on such specifications as therein provided for, and shall indemnify and save harmless the City of Gadsden against or from all costs, expenses, damages, injury or loss, to which the City of Gadsden may be subjected by reason of any doing wrong, misconduct, want of care or skill, negligence, or default, including patent infringement, on the part of the Contractor, his agents, or employees, in the execution or performance of said Contract, and shall promptly pay all just claims for damages or injury to property and for all work done, or skill, tools, machinery, supplies, labor and materials furnished and debts incurred by the Contractor in or about the performance of the work contracted for, this obligation is to be void.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, or alteration or addition to the terms of the Contract or the work to be performed thereunder or the specification accompanying the same shall in any wise affect its obligation under this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specification.

This bond shall be for the use of the City of Gadsden and all persons doing work or furnishing skill, tools, machinery or materials under or for the purpose of the contract hereinabove referred to.

IN TESTIMONY WHEREOF, The Principal and the Surety have caused these presents to be duly signed and sealed on this _____day of _____, 2024.

IN PRESENCE OF:

_____ _____(SEAL)*
Individual Principal

_____ _____
Business Address

_____
Corporate Principal

ATTEST:

_____ By_____(SEAL)*

_____
Business Address

_____
Corporate Surety

ATTEST:

_____ By_____(SEAL)*

_____
Business Address

_____

*Affix Corporate Seals

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____

_____
hereinafter called the Surety, are held and firmly bound unto the City of Gadsden, Alabama, hereinafter called the "City of Gadsden", a municipal corporation, for use of the City of Gadsden, and all persons doing work or furnishing skill, tools, machinery, supplies or materials under or for the purpose of the contract hereinafter referred to, in the full and just sum of

_____

_____Dollars ($_____), in lawful money of the United States of America to be paid to the City of Gadsden, its successors and assigns to which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a contract with the City of Gadsden, dated _____, 2024 for_____

_____
all in strict accordance with the Specifications, and other documents relating thereto; and

WHEREAS, It was one of the conditions of the award by the City of Gadsden, pursuant to which the contract hereinabove referred to was entered into, that these presents shall be executed:

NOW, THEREFORE, The condition of this obligation is such, that, if said principal and all Sub-contractors to whom any portion of the work provided for in said Contract is sublet and all assignees of said Principal and of such Sub-contractors shall promptly make payments to all persons supplying him or them with labor, materials, foodstuffs or supplies for or in prosecution of the work provided for in such Contract as well as repay the City of Gadsden any such which the City of Gadsden may pay because of any lien for labor or materials furnished for the work included in said Contract or any amendment or extension of or addition to said Contract, and for the payment of reasonable attorney's fees, incurred by the Claimant or Claimants, in suits on said bond, the above obligation shall be void, otherwise to remain in full force and effect;

PROVIDED, HOWEVER, that this Bond is subject to the following further conditions and limitations:

(a) Any person, firm, or corporation that has furnished labor, materials, stuffs food, or supplies for or in the prosecution of the work provided for in said Contract shall have a direct right of action against the Principal and Sureties on this bond, right of action shall be asserted in a proceeding instituted in the County in which the work provided for in said Contract is to be performed or in any County in which said Principal or Sureties do business. Such right of action shall be asserted in a proceeding instituted in the name of the Claimant or Claimants for his or their use and benefit against said Principal and Sureties or either of them (but not later than one year after the final settlement of said contract) in which action such claim or claims shall be adjudicated and judgment rendered thereon.

(b) The Principal and Sureties hereby designate and appoint the City Clerk of the City of Gadsden as the agents of each of them to receive and accept service of process or other pleading issued or filed in any

proceeding instituted on this bond and hereby consent that such services shall be the same as personal service on the Principal and/or Sureties.

(c) This bond is given pursuant to the terms of Sections 39-1-1 et seq, Code of Alabama, 1975.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, or alteration or addition to the terms of the contract or the work to be performed thereunder or the specification accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract or to the work of the Specifications.

This Bond shall be for the use of the Owner and all persons doing work or furnishing skill, tools, machinery, or materials under or for the purpose of the Contract hereinabove referred to.

The undersigned principal and surety do further hereby consent and yield to the jurisdiction of the State Civil Courts of Etowah County, Alabama, and shall assure all undertakings under said agreement or contract shall assure and protect all laborers and furnishers of material on said work both as required by applicable law.

IN TESTIMONY WHEREOF, the Principal and the surety have caused these presents to be duly signed and sealed on the _____ day of _____, 2024.

IN PRESENCE OF:

_____ _____
Individual Principal

_____ _____
Business Address

ATTEST:

_____ _____
(Corporate Principal)

By_____(SEAL)*

_____
(Business Address)

_____
(Corporate Surety)

ATTEST: By_____(SEAL)*

_____ _____
(Business Address)

*Affix corporate seals.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____of the Corporation named as principal in the within bond; that _____ who signed the said bond on behalf of the principal was then _____ of said Corporation; that I know his signature, and his signature is genuine; and that said bond was duly signed, sealed and attested for and in behalf of said Corporation by authority of its governing body.

_____(SEAL)*

The rate of premium on this bond is _____per thousand.

Total amount of premium charged, $_____.

Note: The above must be filled in by Corporate Surety.

DIRECTIONS FOR PREPARATION OF PERFORMANCE AND LABOR AND MATERIAL BONDS

1. Individual sureties, partnerships, or corporations not in the surety business will not be acceptable.

2. The name of the Principal shall be shown exactly as it appears in the Contract.

3. The penal sum shall be not less than that required by the Specification.

4. If the Principals are partners, or joint venturers each member shall execute the bond as an individual, with his place of residence shown.

5. If the Principal is a corporation, the bond shall be executed under its corporate seal. If the corporation has no corporate seal, the fact shall be stated, in which case a scroll or adhesive seal shall be affixed following the corporate name.

6. The official character and authority of the person(s) executing the bond for the Principal, if a corporation, shall be certified by the secretary or assistant secretary thereof under the corporate seal, or there may be attached copies of so much of the records of the corporation as will evidence the official character and authority of the officer signing duly certified by the secretary or assistant secretary under the corporate seal to be true copies.

7. The current power-of-attorney of the person signing for the surety company must be attached to the bond.

8. The date of the bond must not be prior to the date of the Contract.

9. The following information must be placed on the bond by the surety company:

   (a) The rate of premium in dollars per thousand; and

   (b) The total dollar amount of premium charged.

10. The signature of a witness shall appear in the appropriate place, attesting to the signature of each party to the bond.

11. Type or print the name underneath each signature appearing on the bond.

12. An executed copy of the bond must be attached to each copy of the Contract (original counterpart) intended for signing.

The full names and residences of persons and firms interested in the foregoing bids; as Principals are as follows:

_____ _____

_____ _____

_____ _____

CONTRACT PROVISION

The Contractor shall comply with Section 107 of the Contract Work Hours and Safety Standard Act (40 USC 327-330) as supplemented by Department of Labor Regulations (29 CFR; Part 5). Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in, surrounding or under working conditions which are unsanitary, hazardous or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor. These requirements do not apply to the purchase of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

The Contractor shall comply with applicable standards, orders or requirements issued under Section 306 of the Clean Air Act (42 USC 1857 (h)), Section 508 of the Clean Water Act (33 USC 1368), Executive Order 11738 and Environmental Protection Agency regulations (40 CFR, Part 15) which prohibits the use under non-exempt Federal contracts, grant or loans of facilities included on the EPA Listing of Violating Facilities. Violations shall be reported to the owner and the USEPA Assistant Administrator for Enforcement. (EN-329)

Contract will recognize as adopted, in the future, any mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy.

_____

Date:_____

CERTIFICATION OF CONTRACT

GADSDEN CITY HALL

Owner:

City of Gadsden

Contractor:

#**3580**

I certify that, to the best of my knowledge, the public works contract named above is let in compliance with Title 39, Code of Alabama, 1975, as amended, and all other applicable provisions of law.

Craig Ford, Mayor

Date

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, the duly authorized and acting legal representative of the City of Gadsden do hereby certify as follows:

I have examined the attached contract(s) and documents executed by the City of Gadsden and I am of the opinion that each of the aforesaid agreements has been duly executed by the City of Gadsden, acting through its duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of Gadsden; that the foregoing agreements constitute valid and legally binding obligations upon the City of Gadsden, in accordance with terms, conditions and provisions thereof; and that the contract is the result of procurement in accordance with Title 39 of the Alabama Code and applicable federal laws, rules and regulations, as they apply to the City of Gadsden.

_____
City Attorney

_____
Date

SECTION 00 6105

GENERAL CONDITIONS

SECTION INCLUDES THE FOLLOWING:

105.1 DEFINITIONS

Wherever used in any of the contract documents, the following meanings shall be given to the terms herein defined:

a. The "Contract" means the contract executed by the Owner and the Contractor, of which these General Conditions form a part. The documents which comprise the contract are set forth in the contract form.

b. The terms "Owner" and "Contractor" mean the respective parties to the contract.

c. The "Engineer" is the Director of Engineering of the City of Gadsden, Alabama, or his duly authorized representative.

d. The term "Project" means the construction work for which is contemplated in whole or in part under this contract.

e. The term "Specifications" means the volume which includes, the Instructions and Forms (Invitation for Bids, Instructions to Bidders, Bid, Bid Bond, non-Collusive Affidavit, Statement of Bidder's Qualifications, Contract and Performance and Payment of Bond or Bonds), the General Specifications (consisting of the General Conditions, the Special Condition, and the General Scope of Work) and the Technical Specifications.

105.2 CONTRACTOR

Only one Contractor is recognized as a party to this Contract, and where the term "Contractor" is used, the prime Contractor who signed this Contract is referred to. For convenience, the Technical Specification have been divided into separate headings or divisions to cover the various trades and types of materials represented in the work, and where terms such as "Concrete Contractor", "Grading Contractor", and other "Contractors" are referred to, it has been for convenience only.

105.3 SUPERINTENDENCE BY CONTRACTOR

a. The Contractor shall give his personal superintendence to the work or have a competent superintendent on the work at all times during progress with full authority to act for him. The Contractor shall also provide an adequate staff for the proper coordination and expediting of his work.

105.4 SUBCONTRACTS

a. The Contractor shall not award any work to any Sub-Contractor without prior approval of the Owner, which approval will not be given until the Contractor submits to it a written statement containing such information as the Owner may require concerning experience and qualifications meeting the technical specification requirements as well as the proposed Sub-Contractor's non-collusion affidavit in the following form:

NON-COLLUSION AFFIDAVIT OF SUBCONTRACTOR

STATE OF _____

COUNTY OF _____

_____, being first duly sworn, deposes and says that:

(1) He is _____of _____
(Owner or Partner or Officer) (Firm)

_____, The Bidder that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all circumstances respecting such Bid;

(3) Such Bid is genuine and is not collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed directly or indirectly with any other Bidder, firm or person to submit a collusive or sham bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Local Authority or any person interested in the proposed Contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

_____
(Signed)

Subscribed and sworn to before me
this _____ day of _____, _____

_____
(Notary Public)

My Commission Expires _____, _____

b. No proposed Sub-Contractor shall be disapproved except for cause.

c. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his Sub-Contractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons **directly employed by him.**

d. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Sub-Contractors to the Contractor by the terms of the General Conditions, Special Conditions and other documents comprising the Contract insofar as they are applicable to the work of Sub-Contractors and to give the Contractor the same power as regards terminating any subcontract the Owner may exercise over the Contractor under any provisions of the Contract. The Contractor shall insert in each of his subcontracts the provisions (appropriately modified) of Sections 105.32, 105.34 and 105.35 of these General Conditions.

e. Nothing contained in the Contract shall create any contractual relation between any Sub-Contractor and the Owner.

f. LIMITATIONS: The Contractor shall not sublet, sell, transfer, assign, or otherwise dispose of the contract or contracts or any portion thereof, or of his right, title, or interest therein, without written consent of the Engineer. If such consent is given, the Contractor will be permitted to sublet a portion of the work, but shall perform with his own organization, work amounting to not less than fifty percent (50%) of the total contract cost. Any items designated by the Engineer as "specialty items" may be performed by sub-contract and the cost of any such specialty items performed by contract may be deducted from the total cost before computing the amount of work required to be performed by the Contractor with his own organization. No subcontracts or transfer of contract shall relieve the Contractor of his liability under the contract and bonds.

105.5 OTHER CONTRACTS

The Owner may award other contracts for additional work, and the Contractor shall fully cooperate with such other Contractors and carefully fit his own work to that provided under other contracts as may be directed by the Owner. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor. Where more than one prime Contractor is employed on the site, it shall be responsibility of the Owner to coordinate the work of all such prime Contractors unless otherwise expressly provided herein.

105.6 FITTING AND COORDINATION OF THE WORK

The Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, Sub-Contractors, or materialmen engaged upon the work. The Contractor shall be prepared to guarantee to each of his Sub-Contractors the dimensions which they may require for the filling of their work to all surrounding work and shall do, or cause his agents to do, all cutting, fitting, adjusting, and patching necessary to make the several parts of the work come together properly and to fit the work to receive, or be received by, that of other Contractors.

105.7 MUTUAL RESPONSIBILITY OF CONTRACTORS

If, through acts of neglect on the part of the Contractor, any other Contractor or any Sub-Contractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or Sub-Contractor by agreement or arbitration, if such other

Contractor or Sub-Contractor will so settle. If such other Contractor or Sub-Contractor shall assert any claim against the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor, who shall defend at his own expense any suit based upon such claim, and, if any judgment or claim against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith.

105.8 PAYMENTS TO CONTRACTOR

a. Subject to submission by the Contractor of the written certifications required of him and his Sub-Contractors by Section 105.32 of the General Conditions, partial payments will be made as the work progresses not later than the fifteenth day of each calendar month for work done during the preceding calendar month on estimates certified by the Engineer. In preparing estimates only the material in place will be considered. Estimates for monthly payments must be submitted at least twenty (20) days in advance of the date set for payment.

b. In making such partial payments for the work there shall be retained five percent (5%) of the estimated amount up to fifty percent (50%) of contract amount until final completion and acceptance of all work covered by the Contract.

c. All work covered by partial payments made shall thereupon become the sole property of the Owner. This provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of work upon which payments have been made or the restoration of any damaged work, whether such damage has been caused by the Contractor or by other Contractors of the Owner or others, or as a waiver of the right of the Owner to require the fulfillment of all terms of the Contract. In the event the work of the Contractor has been damaged by other Contractors or by others than the employees of the Owner in the course of their employment, the Contractor agrees to restore such damaged work without cost to the Owner and to seek redress for his damage only from those who directly caused it.

d. Upon completion and acceptance by the Engineer of all Work required hereunder, the Engineer shall issue a final certificate that the balance is due the Contractor. Immediately after receipt of the final certificate the Contractor shall give notice of said completion of the work by advertisement in some newspaper of general circulation published in the City of Gadsden, Alabama, for a period of four (4) successive weeks. Proof of publication of said notice shall be made by the Contractor to the Owner by affidavit of the publisher, to which affidavit shall be attached a printed copy of the notice, provided by Section 39-1-1(f), 1975 Code of Alabama. Upon the expiration of ten days following the fourth publication, but not earlier than thirty (30) days after the completion and acceptance of the work and issuance of final certificate aforesaid, the Owner shall make final payment to the Contractor of the balance due under the Contract, less such amounts as may have been withheld by the Owner from time to time, as provided for in these specifications.

e. The Owner, before making any payment, may require the Contractor to furnish releases or receipts from all persons performing work and supplying material to the Contractor, if the Owner deems the same necessary in order to protect its interests. The Owner, however, may make payment in part or in full to the Contractor without requiring the furnishing of such releases or receipts and any payments so made shall in nowise impair the obligations of any surety or sureties on any bond or bonds furnished under this contract.

f. The Owner may withhold from any payment otherwise due the Contractor so much as may be necessary to protect the Owner against any

claims that may be urged against the Owner and, if it so elects, may also withhold any amounts due from the Contractor to any subcontractors or materialmen, for labor or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and shall not require the Owner to determine or adjust any claims or disputes between the Contractor and his Sub-Contractors or materialmen, or to withhold any moneys for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any moneys from the Contractor shall in nowise impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

105.9 CHANGES IN THE WORK

a. The Owner may make changes in the work of the Contractor by making alterations therein, or by making additions thereto, or by omitting work therefrom, without invalidating the Contract, and without relieving or releasing the Contractor from any guarantee given by him pursuant to the Contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the conditions of the original contract.

b. Except in an emergency endangering life or property, no change shall be made by the Contractor unless in pursuance of a written order from the Engineer, authorizing the change and no claim for any adjustment of the Contract Price or time shall be valid unless so ordered.

c. In determining the value of any change, either additive or subtractive, the contracting parties are restricted to the use of the three following methods, singly or in combination. Method (1) shall be used to establish the equitable value of the change in every case where it can be fixed prior to performance of the changed work. Method (2) and no other, shall be used to establish changed values for any and all items for which unit prices are set forth in the Contract. Method (3) shall be used only to establish values which are indeterminate otherwise, or in an emergency endangering life or property. The Engineer at the time he issues the written order to proceed shall in the case of both methods (2) and (3), fix a maximum amount to be spent on the work which shall not be exceeded. If additional work remains to be done after that sum has been expended, the additional work shall be the subject of a separate written order.

1. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the Order, and the order shall stipulate the corresponding lump sum adjustment of the Contract Price.

2. The applicable unit price shall be applied to the net change in quantity, estimated or actual as agreed, of the item involved.

3. The order shall direct the Contractor to proceed on a time and material basis, whereupon the Contractor shall so proceed and keep accurately and present, in such form and at such times as the Engineer may require, a correct account of the cost, together with all proper vouchers and supporting papers therefore. Upon completion of the change and agreement upon the total value thereof, the Engineer shall issue a second written order, processed in accordance with the provisions of Section 105.10b or 105.10c, effecting the equitable adjustment of the contract price.

d. Under Methods (1 and (3), for extra work performed, the allowances for overhead and profit combined, included in the total cost to the Owner shall not exceed ten percent (10%) of the Contractors net additional cost. There shall be no additional cost added under method (2).

This percentage shall be applied to the net

additional cost as defined in subsection e. immediately following. If the net cost value of a change results in a credit from the Contractor, the credit given shall be the net cost without overhead or profit.

e. The "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "Cost" as used herein may include all items of labor or materials, the use of power tools and equipment, and all such items of cost as public liability and workmen's compensation insurance, pro rate charges for foremen, social security, old age and unemployment insurance. Among the items to be considered as overhead are insurance other than as mentioned above, bond premiums, supervision, superintendents, timekeepers, clerks, watchmen, small tools, incidental job burdens and general office expense, and all other items not included in the cost as herein defined.

f. Every order issued by the Engineer which effects an adjustment of the contract price shall be supported by itemized, bona fide, written proposal from the Contractor to the Owner, submitted prior to preparation of the order, in multiple copy form as required.

g. Should the Contractor encounter or the Engineer discover during the process of the work, sub-surface or latent conditions at the site materially differing from those shown in the Specifications, the attention of the Engineer shall immediately be called to such conditions before they are disturbed. If the Engineer finds that they so materially differ, he shall at once make such changes in the Specifications as he may find necessary, and any adjustment in the Contract price or time as may be justifiable shall be made by means of a written order as provided herein.

h. Subject to the provisions of Section 10 and 12 of the General Conditions justifiable extensions of Contract time because of changes ordered may be granted by the Owner.

105.10 CLAIMS FOR EXTRA COST

a. If the Contractor claims that any instructions involve extra cost or extension of time, he shall, within ten days after the receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto in writing to the Engineer stating clearly and in detail the basis of his objections. No such claim shall be valid unless so made.

b. Claims for additional compensation for extra work, due to alleged errors in spot elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, and prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more works, than would be reasonably estimated from the plans and maps issued.

c. Any discrepancies which may be discovered between actual conditions and those represented by the maps and plans shall at once be reported to the Engineer, and work shall not proceed, except at the Contractor's risk, until written instructions have been received by him from the Engineer.

d. If, on the basis of the available evidence, the Engineer determines that an adjustment of the Contract price or time is justifiable, the procedure shall then be as provided herein for "Changes in the work".

e. By execution of the Contract, the Contractor warrants that he has visited the site of the proposed work and fully acquainted himself with the conditions there existing relating to construction and labor, that he understands that other contracts will be let for other work, which other work will be performed in the same general area or contiguous thereto during part

or all of the time that he performs his Contract, and that he fully understands the facilities, difficulties and restrictions attending the execution of the work under the Contract, and that he will make no claim for extra compensation because of said conditions, restrictions or difficulties, or because his work has been delayed or interfered with by reason of the fact that others are working in the same general area or contiguous thereto. The Contractor further warrants that he has thoroughly examined and is familiar with the Specifications, and all other documents comprising the Contract. The Contractor further warrants that by execution of this Contract his failure when he was bidding on this Contract to receive or examine any form, instrument or document or to visit the site and acquaint himself with conditions there existing, in no wise relieves him from any obligation under the Contract and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

105.11 RIGHT OF OWNER TO TERMINATE CONTRACT

If the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should persistently or repeatedly refuse or fail to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to his employees or to his Sub-Contractors, or persistently disregard instructions of the Owner or Engineer or fail to observe or perform the provisions of the Contract, or otherwise be guilty of substantial violation of any provision of the Contract, then the Owner may, by at least five days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, terminate the Contractor's right to proceed with the work. In such event, the Owner may take over and prosecute the work to completion, by contract or otherwise and the Contractor and his sureties shall be liable to the Owner for any excess cost occasioned the Owner thereby. In any such case the Owner may take possession of and utilize in completing the work such materials, appliance, and plant as may be on the site of the work and necessary therefore. The foregoing provisions are in addition to, and not in limitation of the Owner's rights under any other provisions of the Contract.

105.12 DELAYS - DAMAGES

a. If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in the Special Conditions, Division 106, or any extension thereof, or fails to complete said work within such times, the Owner may by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Owner may take over the work and prosecute the same to completion, by contract or otherwise and the Contractor and his sureties shall be liable to the Owner for any excess cost occasioned the Owner thereby. If the Contractor's right to proceed is so terminated, the Owner may take possession of and utilize in completing the work such materials, appliances and plant as may be on the site of the work and necessary therefore. Until such time as the Owner terminates the right of the Contractor to proceed, the Contractor shall continue the work, and the Contractor shall pay to the Owner as fixed, agreed and liquidated damages (it being impossible to determine the actual damages occasioned by the delay) for each calendar day of delay until the work is completed, or accepted, or until such time as the Contractor's right to proceed shall be terminated, the amount as set forth in the Special Conditions, and the Contractor and his sureties shall be liable for the amount thereof. In the event the Owner shall at any time

subsequent to the date of completion, as established in the Contract or any amendment thereto, terminate the Contractor's right to proceed, such termination shall not relieve the Contractor of the payment of the liquidated damages which have accrued from the completion date as established in the Contract, up to and including the date of the termination of the Contractor's right to proceed. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to acts of God, or of the public enemy, acts of the Government, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantines, restrictions, strikes, freight embargoes, and unusually severe weather or delays of Sub-Contractors due to such cause, if the Contractor shall within ten (10) days from the beginning of any such delay notify the Engineer in writing of the causes of delay, the Engineer shall ascertain the facts and the extent of delay. The Owner shall extend the time for completing the work when in its judgment the findings of facts of the Engineer justify such an extension, and his findings of fact thereon shall be final and conclusive upon the parties hereto.

b. No payment or compensation of any kind shall be made to the Contractor for damages because of hindrance or delay from any cause in the progress of the work, whether such hindrances or delays be avoidable or unavoidable.

105.13 ASSIGNMENT OF CONTRACT

The Contractor's obligation and duties under this Contract shall not be assigned in whole or in part by the Contractor without the written approval of the Owner, but this shall not prohibit the assignment of the proceeds due hereunder to a bank or financial institution, nor shall this provision preclude the Contractor from subletting, as provided in this Contract, parts of the work in accordance with the general practice of the construction industry. This Contract may be assigned by the Owner to any corporation, agency, or instrumentality authorized to accept such assignment.

105.14 OWNERSHIP OF SPECIFICATIONS

Except the Contractor's executed set, all specifications are and remain the property of the Owner. Such specifications are not to be used on other work, and those sets in usable condition shall be returned to the Owner, upon request, at the completion or cessation of the work or termination of the contract.

105.15 SHOP DRAWINGS

a. Shop drawings of all fabricated work shall be submitted to the Engineer for approval and no work shall be fabricated by the Contractor save at his own risk, until approval has been given. The Contractor will be advised as to the exact procedure to be followed with respect to the number of prints required, where submitted, letters of transmittal, making corrections, etc. Five (5) prints of finally approved shop drawings will be required.

b. The Contractor shall submit all shop drawings on dates sufficiently in advance of requirements to afford the Engineer ample time for checking same, including time for correcting, resubmission and recheck, if necessary, and no claim for extension of the contract time will be granted the Contractor by reason of his failure in this respect.

c. All shop drawings submitted must bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered

and will be returned to the Contractor for proper resubmission. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in his letter or transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though such shop drawings have been approved.

d. Where a shop drawing as submitted by the Contractor indicates a departure from the Contract which the Engineer deems to be a minor adjustment in the interest of the Owner not involving a change in Contract price or extension of time, the Engineer may approve the drawings but the approval will contain, in substance, the following:

"The modification shown on the attached drawing is approved in the interest of the Owner to effect an improvement for the project and is ordered with the understanding that it does not involve any change in the contract price or time; that it is subject generally to all Contract stipulations and covenants; and that it is without prejudice to any and all rights of the Owner under the Contract and bond or bonds."

e. The approval of the shop drawings will be general and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve him of the responsibility for any error which may exist.

105.16 REQUESTS FOR SUPPLEMENTARY INFORMATION

a. It shall be the responsibility of the Contractor to make timely requests of the Engineer for such additional information, not already in his possession, which he will require in the planning and production of the work. Such requests may be submitted from time to time as the need is approached, but each such request shall be filled in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing, and shall list the various items and the latest date by which each will be required by the Contractor. The first list shall be submitted within two weeks after the Contract award and shall be as complete as possible at that time. The Contractor shall, if requested, furnish promptly any assistance and information which the Engineer may require in responding to the requests of the Contractor. The Contractor shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provisions of this Section.

105.17 MATERIALS AND WORKMANSHIP

a. Unless otherwise specifically provided for in the Technical Specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose. Where equipment, materials, articles or workmanship are referred to in the Technical Specifications as "equal" to any particular standard, the Engineer shall decide the question of equality.

b. The Contractor shall furnish to the Engineer for approval the name of the manufacturer of machinery, mechanical and other equipment which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required, and shall likewise submit for approval as required full information concerning the materials or articles which he proposes to incorporate in the work. (See Samples, Certificates, and Tests" Section 20 of the General Conditions).

c. Machinery, mechanical and other equipment, materials or articles installed or used without such prior approval shall be at risk of

subsequent rejection.

d. Materials specified by reference to the number or symbol of a specific standard, such as American Society for Testing Materials, and American Association of State Highway Officials or other similar standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Invitation for Bids, except as limited to type, class or grade, or modified in such reference. The standards referred to, except as modified in the Technical Specifications, shall have full force and effect as though printed therein.

e. Specific reference in the Technical Specifications to any article, device, product, material, fixture, form, or type of construction, etc., by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition, and the Contractor in such cases, may at his option use any article, device, product, or material, fixture, form or type if construction which, in the judgment of the Engineer expressed in writing, is equal to that named.

105.18 SAMPLES, CERTIFICATES AND TESTS

a. No material for which samples are required shall be delivered to the site for use until representative samples have been approved in writing by the Engineer.

b. The Contractor shall furnish for approval all samples (and certificates related to them) as stipulated under the several divisions of the Technical Specifications as well as all other samples as requested by the Engineer. Samples shall be delivered with all transportation charges prepaid to a location designated by the Engineer and in ample time for proper consideration and action. In general, twenty (20) days is the minimum time required for making tests.

c. Pack samples so as to reach their destination in good condition; ship in tight metal containers samples of paste or liquid materials.

d. Label, or otherwise properly mark on the container the material or product represented, its place or origin, the name of the producer, the name of the Contractor, and the name and symbol of the Project for which it is intended.

e. Submit to the Engineer, in triplicate, a certificate describing each sample submitted for approval, certifying that the material, equipment or accessory submitted complies with Contract requirements. The certificate shall include the following information:

1. Name and brand of the product, name of manufacturer, location of plant.

2. Name and location of at least two projects on which substantial quantities of the Material represented by the samples were used, and the approximate dates of use or installation.

3. An outline showing chemical and physical properties of the material represented by the sample submitted and giving the name of the laboratory or testing authority which obtained the data, and the dates of the tests.

(Note: The information required by this sub-paragraph (3) may be omitted in the case of materials required to conform to standard as specified; provided, a certified statement by an acceptable laboratory or testing authority is furnished in lieu thereof.)

4. If the statement originates with the producer, the Contractor shall endorse all claims and submit the statement in his own name; he shall also guarantee that all materials furnished for use on the Project will be in compliance with the samples and certified statements.

f. Approval of any material shall be general only and shall not constitute a waiver of the Owner's

right to demand full compliance with Contract requirements after actual deliveries, the Owner will make such check tests as it deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories which fail to meet check tests have been incorporated in the work, the Owner shall have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the Contractor as is equitable

g. When a material has been approved, no change in brand or make will be permitted unless:

1. The manufacturer cannot make satisfactory delivery; or

2. The material delivered fails to comply with the Contract requirements.

h. Whenever materials are required to comply with A.S.T.M. Standards or AASHO Specifications, and such specification shall be accepted as establishing the technical qualities and testing methods, they shall not govern the number of tests required to be made. The number of tests required on material delivered, for use shall in all cases be at the discretion of the Owner. They may require laboratory tests on samples submitted for approval or they may approve materials on the basis of data submitted in certificates with samples.

i. Check tests will be made on materials delivered for use only as frequently as the Owner considers necessary to insure compliance of materials used with Contract requirements.

j. Except as otherwise specifically stated in the Contract, the costs of sampling and testing will be divided as follows:

1. The Contractor will furnish without extra cost, including packing and delivery charges, all samples required for testing purposes.

2. The Contractor will assume all costs of retesting materials which fail to meet contract requirements.

3. The Contractor will assume all costs of testing materials offered in substitution for those found deficient; and

4. The Owner will pay all other expenses.

105.19 PERMITS AND CODES

The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules and regulations. The contactor shall obtain a City of Gadsden business license and all applicable building permits required prior to commencing work. The intent of this Contract is that the Contractor shall base his bid upon the Specifications, but that all work installed shall comply with all applicable codes and regulations as amended by any waivers. Before installing the work, the Contractor shall examine the Specifications for compliance with applicable codes and regulations bearing on the work, and shall immediately report any discrepancy to the Engineer. Where the requirements of the Specification fail to comply with the applicable code and regulation, the Owner shall adjust by change order the Contract to conform to the code or regulation (unless waivers in writing covering the differences have been granted by the governing authority) and shall make appropriate adjustment in the Contract price. Should the Contractor fail to observe the foregoing provisions and install work at variance with any applicable code or regulation as may be amended by waivers (notwithstanding the fact that such installation is in compliance with the Technical Specifications), the Contractor shall remove such work without cost to Owner, but a change order shall be issued to cover only the excess cost the Contractor would have been

entitled to receive if the change had been made before the Contractor commenced work on the item involved.

105.20 CARE OF THE WORK

a. The Contractor shall be responsible for all damages to persons or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance, whether or not the same has been covered by partial payments made by the Owner, and whether or not the damage to his work was caused by the Contractor or by other Contractors, or by other than the employees of the Owner in the course of their employment.

b. The Contractor shall provide and maintain sufficient barricades, signs signals and competent watchmen required, both day and night, including Saturdays, Sundays, and Holidays, from the time the work is commenced until final completion and acceptance, in accordance with the latest edition of the Alabama Manual on Uniform Traffic Control Devices.

c. In an emergency affecting the safety of life or property, including adjoining property, the Contractor, without special instructions or authorization or authorization from the Owner, is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. Likewise, he shall so act if instructed to do so by the Engineer. Any compensation claimed by the Contractor on account of such emergency work shall be determined by the Engineer, and as provided in the Contract.

d. The Contractor shall avoid damage as a result of his operations to existing sidewalks, streets, curbs, pavements, utilities, adjoining property, the work of other Contractors and the property of the Owner and others, and he shall at his own expense completely repair any damage thereto caused by his operations.

e. The Contractor shall shore up, brace, underpin, secure, and protect as may be necessary all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the Project. The Contractor shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party before the commencement of any work. The Contractor shall indemnify and save harmless the Owner from any damages on account of settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages from which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

105.21 ACCIDENT PREVENTION

The Contractor shall exercise proper precaution at all times for the protection of persons and property. The safety provisions of applicable law, building and construction codes shall be observed, and the Contractor shall be responsible for any additional safety and health measures required to provide a safe construction operation. Machinery equipment and all hazards shall be guarded in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America to the extent that such provisions are not in contravention of applicable law.

105.23 SANITARY FACILITIES

The Contractor shall furnish, install, and maintain ample sanitary facilities for the workmen. As the needs arise, enclosed temporary toilets, in sufficient number, shall be

placed as needed. Drinking water shall be provided from a proved safe source, so piped or transported as to be kept clean and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing governing health regulations.

105.23 USE OF PREMISES

a. The Contractor shall confine his apparatus, storage of materials, and construction operation to the limits prescribed by ordinances or permits or as may be directed by the Engineer, and shall not unreasonably encumber the premises with his materials.

b. The Contractor shall not load any structure or permit any part thereof to be loaded to such an extent as to endanger its safety.

c. The Contractor shall comply with and enforce any instruction of the Engineer, or local laws regarding signs, advertising, fires, danger signals, barricades and smoking.

105.24 REMOVAL OF DEBRIS, CLEANING, ETC.

The Contractor shall, periodically or as directed during the progress of the work, remove and properly dispose of the resultant dirt and debris, and keep the premises reasonably clean. Upon completion of the work, he shall remove all temporary construction, facilities and unused materials provided for the work, and put the project and premises in a neat and clean condition and do all cleaning and washing required by the Specifications. Trash and combustible materials shall not be allowed to accumulate on the premises.

105.25 INSPECTION

a. All material and workmanship shall be subject to inspection, examination or test by the Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction is carried on. The Engineer shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the premises and satisfactorily replaced with proper material without charge thereof. If the Contractor fails to proceed at once with the correction of rejected defective material or workmanship, the Engineer may by contract or otherwise have the defects remedied or rejected materials removed from the site and charge the cost of the same against any moneys which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.

b. The Contractor shall furnish promptly all materials reasonably necessary for any tests that may be required. (See Samples, Certificates and Tests, Section 105.20 of the General Conditions). All tests by the Engineer shall be performed in such manner as not to unnecessarily delay the work. Special, full size, and performance tests shall be as described in the Technical Specifications.

c. If any work be covered up without approval or consent of the Engineer, it must, if requested by the Engineer, be uncovered at the expense of the Contractor. Should it be considered necessary or advisable by the Engineer at any time before final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any material respect, due to fault of the Contractor or his Sub-Contractors, the Contractor shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the

requirements of the examination, replacement cost plus fifteen per cent (15%), shall be allowed the Contractor and he shall, in addition, if completion of the work of the entire Contract has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.

d. Inspection of material and finished articles to be incorporated in the work at the site may be made at the place of production, manufacture, or shipment whenever the quantity justifies it, unless otherwise stated in the Technical Specifications; and such inspection and acceptance, unless otherwise stated in the Technical Specifications, shall be final, except as regards (1) latent defects, (2) departures from specific requirements of the Contract, (3) damage or loss in transit, or (4) fraud or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of material and workmanship for final acceptance as a whole or in part shall be made at the site.

e. Neither inspection, testing, approval nor acceptance of the work, in whole or in part, by the Owner or its agent shall relieve the Contractor of his sureties of full responsibility for materials furnished or work performed not in strict accordance with the Contract.

105.26 REVIEW BY OWNER

The Owner and its authorized representatives and agents, shall, at all times, have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, contracts, books of account, and other relevant data and records; provided, however, that all instructions and approvals with respect to the work shall be given to the Contractor only by the Owner, the Engineer or their authorized representatives or agents.

105.27 FINAL INSPECTION

a. When the work is substantially completed the Contractor shall notify the Engineer in writing that the work will be ready for final inspection on a definite date which shall be stated in such notice. Such notice shall be given at least ten (10) days prior to the date stated for final inspection.

105.28 DEDUCTION FOR UNCORRECTED WORK

If the Owner deems it inexpedient to require the Contractor to correct work injured or not done in accordance with the Contract, an equitable deduction from the Contract Price shall be made by agreement between the Contractor and the Owner.

105.29 INSURANCE

The Contractor shall not commence work under this Contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on this subcontract until the insurance required of the Subcontractor has been so obtained and approved.

a. Worker's Compensation Insurance: The Contractor shall procure and shall maintain during the life of this Contract Worker's Compensation Insurance as required by applicable State or territorial law for all of his employees to be engaged in work at the site of the project under this Contract and, in case of any such work sublet, the Contractor shall require the Subcontractor similarly to provide Worker's Compensation Insurance for all of the work unless such employees are covered by the protection afforded by the Contractor's Worker's Compensation

Insurance. In case any class of employees engaged in hazardous work on the project under this Contract is not protected under the Worker's Compensation Statute, the Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance for the protection of such of his employees as are not otherwise protected.

b. Commercial General Liability Insurance and Auto Insurance: The Contractor shall procure and shall maintain during the life of this Contract Commercial General Liability and Auto Liability. The Auto Liability shall cover all owned, non-owned and hired autos. Insurance limits shall be provided in the amounts specified below.

The Contractor's Commercial General Liability Insurance shall have the following limits of $1,000,000 each occurrence; $2,000,000 General Aggregate; $2,000,000 Products/Completed Operations Aggregate and $1,000,000 Personal and Advertising Injury. This shall be written on a Per Project Basis with coverage being primary/non-contributory and include a 30-day notice. The Auto Liability shall have a $1,000,000 limit on Each Accident Combined Single Limit.

c. Subcontractor's Commercial General Liability Insurance: The Contractor shall either (1) require each of his Subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Commercial General Liability and Auto Liability Insurance of the type and in the limits specified in subparagraph (b) hereof, or (2) insure the activities of his policy, specified in subparagraph (b) hereof.

d.

e. Scope of Insurance and Special Hazards: The insurance required under subparagraphs (b) and (c) hereof shall provide adequate protection for the Contractor and his Subcontractor, respectively, against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him and, also against any of the special hazards which may be encountered in the performance of this Contract. It is required that the Owner be added as additional insured under the Contractor's, and Subcontractor's Commercial General Liability for both ongoing and completed operations. Completed operations shall be defined as a period of 2 years following final payment. The Owner shall also be listed as additional insured under the Auto Liability and Umbrella Liability. The Commercial General Liability, Auto Liability and Umbrella Liability shall also include a waiver of subrogation for the Owner.

f. Builder’s Risk Insurance (Fire Extended Coverage): Until the project is completed and accepted by the Owner, the Contractor is required to maintain Builders risk Insurance (fire and extended coverage) on a 100 percent (100%) completed value basis on the insurable portion of the project (all structures and buildings above grade) for the benefit of the Owner, the Contractor, and the Subcontractors as their interests may appear. This provision shall not release the Contractor from his obligation to complete, according to plans and specifications, the project covered by the Contract, and the Contractor and his Surety shall be obligated to full performance of the Contractor's undertaking.

g. Proof of Carriage Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class

of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be cancelled or materially altered, except after (30) days written notice has been received by the Owner.

h. Umbrella Liability Coverage: The Contractor shall provide Umbrella Liability coverage with a limit of liability of not less than $1,000,000 and shall apply to the Commercial General Liability, Auto Liability and Employers Liability coverage.

i. Owner's Protective Liability Policy: **The Contractor shall furnish an Owner's Protective Liability Policy which lists the Owner as Named Insured. This insurance coverage shall be provided in a policy separate from the Contractor's insurance policies, and a copy of the policy shall be provided to the Engineer. The limits of liability shall not be less than $1,000,000.**

j. The Contractor hereby agrees to hold harmless, indemnify and defend the Owner, the Owner's agent, Consulting Engineer, and the Owner's employees while acting within the scope of their duties from and against any and all liability, claims, damages and cost of defense arising out of the Contractor's performance of the work described herein but not including the sole negligence of the owner, his agents or employees. The Contractor will require any and all subcontractors to conform with the provisions of this clause prior to commencing any work.

Sample Certificates of Liability follow:

105.30 OMIT

105.31 QUALIFICATIONS FOR EMPLOYMENT

No persons under the age of sixteen (16) years and no person undergoing sentence of imprisonment shall be employed in the development of the Project. No person whose age or physical condition is such as to make his employment dangerous to his health or safety or to the health and safety of others shall be employed in the development of the Project, provided, that this shall not operate against the employment of physically handicapped persons, otherwise employable, where such persons may be safely assigned to work which they can ably perform.

105.32 NON-REBATE OF WAGES

The Contractor agrees to comply with the regulations, rulings, and interpretations of the Secretary of Labor of the United States pursuant to the Anti-Kickback Act (Title 18, U.S.C., Sec. 874 and Title 40 U.S.C. Sec. 276c) which makes it unlawful to induce any person employed in the construction or repair of public buildings or public works to give up any part of the compensation to which he is entitled under his contract of employment, and the Contractor agrees to insert a like provision in all Sub-Contractors hereunder.

105.33 WAGE CLAIMS AND ADJUSTMENTS

In cases of underpayment of salaries or wages to any engineers, technicians, laborers, or mechanics by the Contractor or any of his Sub-Contractors, the Owner may withhold from such Contractor out of payment due, an amount sufficient to pay persons employed on the work covered by the Contract the difference between the salaries or wages required to be paid under the Contract and the salaries or

wages actually paid such employees for the total number of hours worked, and the amounts withheld may be disbursed by the Owner for and on account of the Contractor or the Sub-Contractor to the respective employees to whom they are due. The Owner shall in cases of such underpayment withhold such moneys, provided, that the Owner shall not be considered in default under this sentence if it has in good faith made payments to the Contractor in reliance upon an affidavit of the Contractor that the salaries and wages required under his contract have actually been paid.

105.34 PATENTS

The Contractor shall hold and save the Owner, its officers, and employees, harmless from liability of any nature of kind, including costs and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract.

105.35 WARRANTY OF TITLE

No material, supplies or equipment for the work shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Contractor warrants good title to all materials, supplies, and equipment installed or incorporated in the work and agrees, upon completion of all work, to deliver the premises together with all improvements and appurtenances constructed or placed thereon by him to the Owner free from any claims, liens, or charges and further agrees that neither he nor any person, firm or corporation furnishing any material or labor for any work covered by this contract shall have any right to a lien upon the premises or any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provision of this paragraph shall be inserted in all sub-contracts and material contracts and notice of its provision shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

105.36 GENERAL GUARANTY

Neither the final certificate of payment nor any provision in the Contract nor partial or entire use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall promptly remedy any defect in the work and pay for any damage to other work resulting therefrom which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Engineer will give notice of observed defects with reasonable promptness.

105.37 LIVE UTILITIES AND OTHER PROPERTY

The Contractor shall assume all responsibility for damage to any property upon, or passing through, the site but excluded from the work or not owned by the Owner, such as utility lines or like items.

105.38 TRUCK WEIGHTS

The weights of trucks hauling materials for this project shall meet the requirements of Chapter

9, Article 2, of Title 32, Code of Alabama, 1975.

105.39 INDEMNIFICATION

a. The Contractor will indemnify and hold harmless the Owner and the Engineer and 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 that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, Sub-Contractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

b. In any and all claims against the Owner or the Engineer, or any of their agents or employees, by an employee of the Contractor, any Sub-Contractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any Sub-Contractor under workmen's compensation acts, disability benefits acts or other employee benefits acts.

105.40 LIMITATIONS ON RESPONSIBILITIES

a. Neither the authority of the Owner or Engineer to act under this Section 105, nor any decision made by either of them in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility to the Contractor, Sub-Contractor, any of their agents or employees or any other person performing any of the Work.

b. Neither the Owner nor the Engineer will be responsible for the construction means, methods, techniques, sequences or procedures, or the safety precautions and program incident thereto, nor will they be responsible for the Contractor's failure to perform the Work in accordance with the Contract Documents.

c. Neither the Owner nor the Engineer will be responsible for the acts or omissions of the Contractor, any Sub-Contractor, any Supplier or any of his or their agents or employees, or any other persons performing or furnishing any of the Work.

d. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of the Owner or Engineer as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to the Owner or Engineer any duty or performance of the Work or any duty or authority to undertake responsibilities contrary to the provisions of paragraph 105.41b. or 105.41c.

105.41 SAFETY AND PROTECTION

a. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees on the Work and other persons

and organizations who may be affected thereby;

2. All work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

b. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property or to their protection from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 105.41b. or 105.41c. caused, directly or indirectly in whole or in part, by Contractor, any Sub-Contractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be responsible, shall be remedied by Contractor (except damage or loss attributable to the fault of the Specifications or to the acts or omissions of the Owner or Engineer or anyone employed by either of them or anyone for whose acts either of them may be responsible, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor). Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and accepted by the Owner and Engineer.

c. Contractor shall designate a responsible representative at the site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated by Contractor to Owner.

d. EMERGENCIES: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from the Engineer or Owner, shall act immediately to prevent threatened damage, injury or loss. Contractor shall give the Engineer and Owner prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Engineer determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variations.

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
	PHONE (A/C, No, Ext): FAX (A/C, No):
	E-MAIL ADDRESS:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	X COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE X OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	POLICY X PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	X UMBRELLA LIAB X OCCUR						EACH OCCURRENCE	$ 1,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 1,000,000
	DED RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N						X PER STATUTE OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) N/A						E.L. EACH ACCIDENT	$ 1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

CITY-54

City of Gadsden
90 Broad Street
Gadsden, AL 35901

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

ACORD 25 (2016/03)

SECTION 00 6110

SUPPLEMENTAL GENERAL CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents:
   1. General Conditions.
   2. Division 01 - General Requirements.

1.2 GENERAL

A. The following supplements modify, delete from, or add to the General Conditions referenced above.
B. Where provisions of the General Conditions are modified, unaltered provisions remain in effect.

1.3 ADDITIONAL REQUIREMENTS

A. Preliminary Drawings and Specifications – Prior to beginning construction, Contractor shall mark all preliminary drawings as VOID and ensure no preliminary drawings will be used during construction. Contractor shall further direct his subcontractors, vendors, and trades to do likewise. At execution of the construction contract, the Contractor and his subcontractors shall certify that all contracts reflect the provisions of the current and official drawing revision that will be used to obtain permits and licenses from the Authorities Having Jurisdiction (AHJ).

B. Drawings and Specifications for Permitting – Contractor will be furnished computer .pdf files for bidding, building permits, and construction transmitted by email. These drawings and specifications will be labeled *Drawings and Project Manual for Construction* and will contain the Architect's Alabama registration seal. The Contractor is authorized to make sufficient copies as is required by the AHJ for submittals and procuring all required permits. The Project Manual may also be referred to as "Project Specifications."

C. Revised Drawings and Specifications - In the event that drawings are revised due to subsequent changes by the Owner or comments by the AHJ, the Contractor will be furnished amended documents by emailed .pdf files, either by individual sheet, or groups of sheets, or full set. Contractor is responsible for distribution and receipt of amended sheets to all subcontractors, vendors, and trades.

D. Drawings and Specifications for Construction– Contractor will maintain the official printed permit set of drawings and specifications for use as the master construction set. These drawings will be labeled Drawings and Project Manual For Construction and will contain the Architect's Alabama registration seal, and the AHJ certification stamp. The Contractor alone is authorized to make an unlimited number of copies for his and his sub-contractors' use, at the Contractor's expense. Such authorization shall expire at the completion of construction, and all drawings that can be accounted for, except final record sets, shall be destroyed or returned to Architect.

E. Additional Insured Provisions – Contractor's General, Automobile, and Umbrella Liability Insurance Policies shall name the Owner, the Architect, and their agents, consultants, and employees as Additional Insureds, stating that this coverage shall be the primary insurance for the Additional Insureds, and contain no exclusions of the Additional Insureds relative to job accidents. Architect must be furnished Certificates of Insurance listing Architect and consultants as Additional Insured. This requirement is in addition to the General Conditions of the Contract.

F. Liquidated Damages – Time is the essence of the Contract. Any delay in the completion of the Work required by the Contract Documents may cause inconvenience to the public and loss and

damage to the Owner including but not limited to interest and additional administrative, architectural, inspection and supervision charges. By executing the Construction Contract, the Contractor agrees that the Contract Time is sufficient for the achievement of Substantial Completion. A time charge equal to six percent interest per annum on the total Contract sum may be made against the Contractor for the entire period after expiration of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work.

The amount of liquidated damages that are due may be deducted by the Owner from the moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, or the amount may be recovered from Contractor or its Surety. If part of the Work is substantially completed within the Contract Time and part is not, the stated charge for liquidated damages shall be equitably prorated to that portion of the Work that the Contractor fails to substantially complete within the Contract Time. It is mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

END OF SECTION

DRAFT

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:

PROJECT:

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR: General Construction
CONTRACT DATE:
PROJECT NOS: 18-035.00 / / /

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

FROM CONTRACTOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM		$0.00
2. NET CHANGE BY CHANGE ORDERS		$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)		$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$0.00	
b. 0 % of Stored Material (Column F on G703)	$0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)		$0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$0.00
8. CURRENT PAYMENT DUE		$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$0.00	$0.00
Total approved this Month	$0.00	$0.00
TOTALS	$0.00	$0.00
NET CHANGES by Change Order		$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

(3B9ADA41)

DRAFT **AIA® Document G703™ – 1992**

Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:	001
APPLICATION DATE:	
PERIOD TO:	
ARCHITECT'S PROJECT NO:	

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G ÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00%**	**$0.00**	**$0.00**

DRAFT

AIA® Document G701™ – 2017

Change Order

PROJECT: *(Name and address)*	**CONTRACT INFORMATION:** Contract For: General Construction Date:	**CHANGE ORDER INFORMATION:** Change Order Number: 002 Date:
OWNER: *(Name and address)*	**ARCHITECT:** *(Name and address)* Williams Blackstock Architects, Inc. 2204 1st Avenue S Suite 200	**CONTRACTOR:** *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	$ 0.00
The net change by previously authorized Change Orders	$ 0.00
The Contract Sum prior to this Change Order was	$ 0.00
The Contract Sum will be increased by this Change Order in the amount of	$ 0.00
The new Contract Sum including this Change Order will be	$ 0.00

The Contract Time will be increased by Zero (0) days.
The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

Williams Blackstock Architects, Inc. **ARCHITECT** *(Firm name)*	**CONTRACTOR** *(Firm name)*	**OWNER** *(Firm name)*
SIGNATURE	**SIGNATURE**	**SIGNATURE**
Stephen Allen, Principal **PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**
DATE	**DATE**	**DATE**

DRAFT

AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: General Construction Date:	**CERTIFICATE INFORMATION:** Certificate Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE OF SUBSTANTIAL COMPLETION**

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first.
The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**
OWNER *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**

DRAFT

AIA® Document G705™ – 2001

List of Subcontractors

PROJECT: *(Name and address)*

DATE:

TO ARCHITECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

FROM CONTRACTOR: *(Name and address)*

CONTRACTOR'S PROJECT NUMBER:

(List Subcontractors and others proposed to be employed on the above Project as required by the bidding documents.)

Work/Firm Name	Address/Phone	Superintendent

DRAFT

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

CONTRACT FOR: General Construction

TO OWNER: *(Name and address)*

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☒ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

DRAFT

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR: General Construction

CONTRACT DATED:

TO OWNER: *(Name and address)*

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

DRAFT

AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR: General Construction	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐
		OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(*Insert name and address of Surety*)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

DRAFT

AIA® Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER: 18-035.00

CONTRACT FOR: General Construction

CONTRACT DATED:

TO OWNER: *(Name and address)*

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

DRAFT

AIA® Document G709™ – 2001

Work Changes Proposal Request

PROJECT *(Name and address)*:

PROPOSAL REQUEST NUMBER: 001

DATE OF ISSUANCE:

OWNER *(Name and address)*:

CONTRACT FOR: General Construction

CONTRACT DATE:

FROM ARCHITECT *(Name and address)*:

ARCHITECT'S PROJECT NUMBER:

TO CONTRACTOR *(Name and address)*:

OWNER: ☐
ARCHITECT: ☐
CONSULTANT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within Zero (0) days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

DESCRIPTION *(Insert a written description of the Work)*:

ATTACHMENTS *(List attached documents that support description)*:

REQUESTED BY THE ARCHITECT:

(Signature)

(Printed name and title)

DRAFT

AIA® Document G710™ – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: General Construction Date:	**ASI INFORMATION:** ASI Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.
(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

DRAFT

AIA® Document G714™ – 2017

Construction Change Directive

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: General Construction Date:	**CCD INFORMATION:** Directive Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
   - ☒ Lump Sum decrease of $0.00
   - ☐ Unit Price of $ per
   - ☐ Cost, as defined below, plus the following fee:
     (Insert a definition of, or method for determining, cost)
   - ☐ As follows:

2. The Contract Time is proposed to remain unchanged. The proposed adjustment, if any, is (0 days).

NOTE: The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*	**OWNER** *(Firm name)*	**CONTRACTOR** *(Firm name)*
SIGNATURE	**SIGNATURE**	**SIGNATURE**
PRINTED NAME AND TITLE	**PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**
DATE	**DATE**	**DATE**

DRAFT

AIA® Document G716™ – 2004

Request for Information ("RFI")

TO:

FROM:

PROJECT:

ISSUE DATE:

RFI No. 001

REQUESTED REPLY DATE:

PROJECT NUMBERS:

COPIES TO:

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*
SPECIFICATIONS: **DRAWINGS:** **OTHER:**

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

BY **DATE** **COPIES TO**

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

SECTION 01 1000

SUMMARY

PROJECT

1.01 PROJECT NAME: GADSDEN CITY HALL

A. Project Location: Broad Street – Gadsden, AL

B. Owner: City of Gadsden

C. Architect: Williams Blackstock Architects

D. WBA Project No: 23-083.00

E. Time of Completion: Per milestones listed below:

1. Notice to Proceed (NTP): On or around January 8, 2025
2. Construction Duration: 460 calendar days from actual NTP
3. Final Completion: 30 days from actual Substantial Completion.

F. Liquidated Damages: See Supplemental General Conditions.

G. Weather Days:

1. A delay beyond the Contractor's control at any time in the commencement or progress of Work by an act or omission of the Owner, Architect, or any separate contractor or by labor disputes, unusual delay in deliveries, unavoidable casualties, fires, abnormal floods, tornadoes, or other cataclysmic events of nature, may entitle the Contractor to an extension of the Contract Time provided, however, that the Contractor shall, within Ten (10) calendar days after the delay first occurs, give written notice to the Architect of the cause of the delay and its probable effect on progress of the entire Work.
2. Adverse weather conditions that are more severe than anticipated for the locality of the Work during any given month may entitle the Contractor to an extension of Contract Time provided, however;
    a. the weather conditions had an adverse effect on construction scheduled to be performed during the period in which the adverse weather occurred, which in reasonable sequence would have an effect on completion of the entire Work,
    b. the Contractor shall, within Twenty-one (21) calendar days after the end of the month in which the delay occurs, give the Architect written notice of the delay that occurred during that month and its probable effect on progress of the Work, and
    c. within a reasonable time after giving notice of the delay, the Contractor provides the Architect with sufficient data to document that the weather conditions experienced were unusually severe for the locality of the Work during the month in question. Unless otherwise provided in the Contract Documents, data documenting unusually severe weather conditions shall compare actual weather conditions to the average weather conditions for the month in question during the previous five years as recorded by the National Oceanic and Atmospheric Administration (NOAA) or similar record-keeping entities.

1.02 THE WORK:

A. This project includes the renovation of two existing buildings and the construction of an addition between those to create a new City Hall for the City of Gadsden. Approximately 23,400 SF of the existing 3-story Regions building will be renovated, which is the entire building minus the recently renovated Region's tenant space on the first floor. A garage with an area of approximately 850 SF is being added to the east side of the building. The existing 2-story Merrill Lynch building, which has a total area of approximately 14,000 SF, will have limited scope. With the construction of a new 15,500 SF Council Chamber addition, the entire combined building area, including renovated and new space, will be approximately 64,000 SF.

C. The site is located off Broad Street in the city block between 2nd and 3rd Streets. Selective demolition will be required to complete the renovations. The project includes, but is not limited to, site demolition, grading, utility fit-up, erosion and sediment control as well as miscellaneous sitework such landscaping/irrigation, hardscape, and parking lot improvements.

1.03 AREA SUMMARY

A.	Exist. 3-story Regions Building (City Hall)	24,500 SF approx.
B.	Exist. Regions 1st Floor Tenant Space (No Work)	9,200 SF approx.
B.	Exist. 2-story Merrill Lynch Building (Limited Work)	14,000 SF approx.
C.	New 2-story Infill Addition (Council Chambers)	15,500 SF approx.
D.	New Garage Addition	850 SF approx.
D.	**TOTAL**	**64,000 SF approx.**

1.04 CONTRACT DESCRIPTION

A. Contract Type: See Section 00 6104.

1.05 OWNER OCCUPANCY

A. The site is located within the existing Mobile County Sportsplex at the junction of I-65 and I-10 in Mobile, Alabama. Construction activities cannot disturb the operations of the Complex at any point during the course of the Work.

B. Cooperate with Owner and adjacent property Owner's to minimize conflict and to facilitate Owner's operations and the use of the site by Owner's design and testing consultants.

C. Schedule and sequence the Work to allow the Owner's Consultants to conduct subsurface investigations, testing, site evaluations and surveying as instructed and indicated in the Contract Documents.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Provide Access to and from the site as required by Law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during the construction period; provided temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without a permit from Authorities Having Jurisdiction and Owner approval.
   3. Areas of the site not included in the Limits of the Work cannot be used for any purpose by the Contractor.
   4. Time restrictions: As outlined by the Owner, and as outlined specifically in the Contract Documents.
   5. Utility Outages and Shutdown:
      a. Do not disrupt or shut down any utilities or life safety systems of buildings or facilities not identified to be demolished on the Drawings.
      b. Prevent accidental disruption of utility services to other facilities.
      c. Limit disruption of utility services to hours the building and impacted facilities are unoccupied.
      d. Do not disrupt or shut down any utility or building system, without Fourteen (14) calendar days written notice to Owner and authorities having jurisdiction.
      e. Shutdown of utility services must be arranged with approval of the Owner, identifying an agreed shutdown duration, and arranged at least Fourteen (14) calendar days in advance with Owner, with a confirming notification 24 hours in advance of the shutdown.
      f. Prevent accidental disruption of utility services to other facilities.
   6. Cooperate with Owner to minimize conflicts with traffic, deliveries and maintenance to facilitate Owner's operations.

7. Schedule the Work to minimize conflicts with traffic, deliveries and maintenance to facilitate Owner's operations.
8. Notify and coordinate with the Owner any potential disruptions to Complex's operations required to complete the Work at least Fourteen (14) calendar days in advance.

1.08 CONTRACTOR PROJECT MANAGEMENT AND ON-SITE PERSONNEL

A. Project Superintendent: The contractor shall have a full-time, on-site Project Superintendent for the duration of the contract work.

B. Project Manager: The contractor shall have a Project Manager assigned to the project fulfilling the duties and requirements for the contract work. However, this person is not required to be on-site and is not required to be full-time. Their time may be allocated to other projects as long as their duties and responsibilities for this project are being fulfilled.

C. Other On-Site and Administrative Personnel: As outlined in the Contract.

1.09 ALL DIVISION 00 AND 01 SPECIFICATION SECTIONS ARE APPLICABLE TO ALL CONTRACTS.

A. All provisions of the sections (Divisions 00 and 01) apply to any and all contracts and subcontracts. Specific items of work listed under individual contract descriptions may constitute exceptions, or additional inclusion.

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION-NOT USED

END OF SECTION 01 1000

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Contract, General and Supplementary Conditions: Contract Sum, retainages, payment period, monetary values of unit prices.

B. Section 01 2100 - Allowances: Payment procedures relating to allowances.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703 1992.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in duplicate within Fifteen (15) calendar days after date of Owner-Contractor Agreement, or Date established in NTP.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

E. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Form AIA G702 and Form AIA G703, 1992 edition .

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage, defined as Five (5) percent of the first Fifty (50) percent of the total project amount.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

I. Submit one electronic and three hard-copies of each Application for Payment.

J. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 3000.
   2. Construction progress schedule, revised and current as specified in Section 01 3000.
   3. Partial release of liens from major subcontractors and vendors.
   4. Affidavits attesting to off-site stored products.

K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.

B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within Seven (7) calendar days.
   1. If the Contractor fails to submit pricing information within the required timeframe the amount and any associated impact on the contract time shall be determined by the Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
   4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:

a. Quantities of products, labor, and equipment.
b. Taxes, insurance, and bonds.
c. Overhead and profit.
d. Justification for any change in Contract Time.
e. Credit for deletions from Contract, similarly documented.

2. Support each claim for additional costs with additional information:
a. Origin and date of claim.
b. Dates and times work was performed, and by whom.
c. Time records and wage rates paid.
d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2000

SECTION 01 2100

ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - PRICE AND PAYMENT PROCEDURES: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts, less applicable taxes.

B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the 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:

4. Assist Architect in selection of products, suppliers, and installers.
5. Obtain proposals from suppliers and installers and offer recommendations.
6. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
7. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
8. 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 only. The quantity of materials noted as an allowance shall be figured adequately to provide all necessary materials to perform the work, including samples, sample panels, mockup, overage, waste, attic stock, and any other specific requirements noted in a given Specification or Drawing.

1.04 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by Change Order.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.05 ALLOWANCES - See Proposal Form

A. Owner's Contingency Allowance: Include the stipulated sum of $400,000 to be incorporated at the sole discretion and direction of the Owner.

B. Section 04 2000: Include the stipulated sum not to exceed $750 per thousand for purchase and delivery of Veneer Brick. Mortar and Accessories to be included in the Base Project Price.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 6102 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 01 2100 - Allowances, for cash allowances affecting this section.

C. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

D. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
      c. Lead Time / Schedule Impact.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

B. Substitutions: See General Conditions for definition.

1.04 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

D. Limit each request to a single proposed substitution item.

3.02 RESOLUTION

3.03 ACCEPTANCE

END OF SECTION 01 2500

SECTION 01 3100

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Coordination

B. Progress Meetings: Owner Architect Contractor (OAC)

C. Preconstruction Conference

D. Preinstallation Conferences

E. Construction Progress Schedule

F. Progress Photographs

G. Submittals

H. Coordination drawings and Record Documents

I. Submittals for review, information, and project closeout

J. Submittal procedures

K. RFIs: Requests for Information

L. Electronic File Transfer.

1.02 RELATED REQUIREMENTS

A. Division 0 - General Conditions of the Contract: Dates for applications for payment.

B. Division 0 - Supplemental Conditions.

C. Section 01 5000 - Temporary Facilities and Controls.

D. Section 01 6000 - Product Requirements: Substitution procedures.

E. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

F. Section 01 7800 - Closeout Submittals: Project record documents.

G. Section 01 7900 - Demonstration and Training

1.03 PROJECT COORDINATION

A. Cooperate with the Architect and Owner in allocation of mobilization areas of site; for field offices and sheds, for storage access, traffic, and parking facilities.

B. During construction, coordinate use of site and facilities through the Architect and Owner.

C. Comply with Project Architect's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

D. Project Closeout Meeting: When project construction reaches Ninety-fit (95) percent complete, schedule a closeout meeting to discuss in detail all requirements for completing and closing out the project.
   1. Refer to Division 1 Section “Closeout Procedures” for project closeout items.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

F. Comply with instructions of the Architect and Owner for use of temporary utilities and construction facilities.

G. Make the following types of submittals to Architect and copy the Architect:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DOCUMENT SUBMITTALS

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet, or cloud-based program that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in PDF format.
   4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
   5. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
      a. Samples or items to be reviewed for color, texture, or finish shall require submittal as physical samples. Contractor to discuss at beginning of job if their or submittals that cannot be processed electronically with the Construction Manager and Architect.

B. Cost: The cost of the service (if any) is to be paid by Contractor; include the cost of the service in the contract sum.

C. Submittal Service: The selected service is:
   1. Newforma Project Cloud: www.newformaprojectcloud.com.

D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
   1. Representatives of Owner are scheduled and included in this training.

E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Schedule (coordinate available times with all parties) and administer OAC (Owner, Architect, Contractor) meetings throughout progress of the Work at maximum weekly intervals, but more often as the pace of the Work dictates.
   2. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   3. Agenda: Prepare the meeting agenda and distribute the agenda to all invited attendees one day prior to meeting.
   4. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within four (4) days of the meeting.

B. Progress Meetings: Conduct progress meetings at weekly or bi-weekly intervals as agreed by Owner Architect and Owner's Project Manager. Coordinate dates of meetings with preparation of payment requests.
   1. Attendees: In addition to representatives of Owner, Owner's Project Manager and Architect, each subcontractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule of progress planned for next two-week period.
      b. Review present and future needs of each entity present, including the following:
         1) Review of submittal schedule and status of submittals.
         2) Review of work progress.
         3) Sequence of operations.
         4) Review of off-site fabrication and deliveries schedule.
         5) Progress cleaning.
         6) Quality and work standards.
         7) Status of correction of deficient items.
         8) Field observations, problems, and decisions.
         9) Identification of problems that impede, or will impede, planned progress.
         10) RFIs.
         11) Status of proposal requests.
         12) Pending changes.
         13) Status of Change Orders.
         14) Documentation of information for payment requests.
         15) Maintenance of progress schedule.
         16) Corrective measures to regain projected schedules.
         17) Coordination of projected progress.
         18) Maintenance of quality and work standards.

19) Effect of proposed changes on progress schedule and coordination.
20) Other business relating to Work.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present for their information and action.
   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

3.03 PRECONSTRUCTION CONFERENCE

A. The Architect will schedule a Preconstruction conference before starting construction, at a time convenient to Owner and Contractor, but no later than Fourteen (14) calendar days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Execution of the Owner-Contractor Agreement.
      b. Submission of executed bonds and insurance certificates.
      c. Tentative construction schedule.
      d. Phasing.
      e. Critical work sequencing and long-lead items.
      f. Submission of final list of Subcontractors, list of products, schedule of values, and progress schedule.
      g. Designation of key personnel and their duties.
      h. Procedures for processing field decisions, Proposal Requests, and Change Orders.
      i. Procedures for testing and inspecting.
      j. Procedures for processing Applications for Payment.
      k. Distribution of the Contract Documents.
      l. Submittal procedures.
      m. Preparation of Record Documents.
      n. Closeout procedures.
      o. Use of the premises and existing building.
      p. Work restrictions.
      q. Working hours.
      r. Owner's occupancy requirements.
      s. Responsibility for temporary facilities and controls.
      t. Construction waste management and recycling.
      u. Parking availability.
      v. Office, work, and storage areas.
      w. Equipment deliveries and priorities.
      x. First aid.
      y. Security.
      z. Progress cleaning.
   3. Minutes: Record and distribute meeting minutes within four days after the meeting to participants, with copies to the Architect, Owner, participants, and those affected by decisions made.

3.04 PREINSTALLATION CONFERENCES

A. Contractor shall schedule and conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction Trades and as indicated in requirements of other Sections.
   1. Contractor to submit schedule of required pre-installation meetings for Architect's review and concurrence. Schedule meetings in conjunction with OAC Meetings.
   2. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner's Project Manager of scheduled meeting dates.
   3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration. Discuss items of significance that could affect installation and warranties, including the following:
      a. Inspection and requirements.
      b. Environmental conditions required for execution of the work and protection of completed installations.
      c. Schedule including required inspections.
      d. Requirements and tolerances of substrates or contiguous work.
      e. Review requirements to ensure an enforceable warranty with manufacturer confirmation.
      f. Review the following prior to each construction activity:
         1) Respective specification Section.
         2) Submittals, product data, and shop drawings.
         3) Manufacturer’s recommendations, requirements, and instructions.
         4) Photographs and other documentation that pertains to the warranty of the product.
         5) Samples of the product or material.
      g. Related RFIs.
      h. Related Change Orders.
      i. Purchases and deliveries.
      j. Submittals under review.
      k. Review of mockups.
      l. Possible conflicts and compatibility problems.
      m. Time schedules.
      n. Weather limitations.
      o. Manufacturer's written recommendations.
      p. Warranty requirements.
      q. Compatibility of materials.
      r. Acceptability of substrates.
      s. Temporary facilities and controls.
      t. Space and access limitations.
      u. Regulations of authorities having jurisdiction.
      v. Testing and inspecting requirements.
      w. Installation procedures.
      x. Coordination with other work.
      y. Required performance results.
      z. Protection of adjacent work.
      aa. Protection of construction and personnel.
   4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   5. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present within four days after the meeting.

6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within Fifteen (15) calendar days after date of established in Notice to Proceed, submit preliminary schedule and CPM diagram defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within Ten (10) calendar days.

C. Within Ten (10) calendar days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.
   2. Include O.F.C.I. scheduling needs for specific products to begin scheduling coordination with the Owner.

D. Within Ten (10) calendar days after joint review, submit complete schedule.

E. The final Project Schedule will be generated and maintained by the Contractor utilizing the Contractor's and Subcontractor's approved progress schedule logic and durations.

F. Submit an updated schedule with each Application for Payment with updated logic and durations to meet the Owner's Completion Date. Provide any necessary updates for delivery and installation of any O.F.C.I. materials based on actual construction progress.

G. Submittal/Shop Drawing Schedule: With the proposed and final schedule, submit information showing the time required to prepare, submit and approve shop drawings and submittals, to fabricate and deliver materials and equipment, and to install the Work. This information shall be provided for all major structural, mechanical, plumbing, electrical and fire protection systems, as well as major architectural finishes (exterior and interior).

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than Five (5) calendar days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

E. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Take photographs at intervals no longer than Five (5) calendar days prior to each application for payment and as follows:
      a. Completion of site clearing.
      b. Excavations in progress.
      c. Forming of foundations in progress during placement of foundations and upon completion of foundations.
      d. Structural framing in progress, prior to any concealment and upon completion.
      e. Enclosure of building, upon completion.
      f. Mech/Elec/Plumbing/Fire Protection wall, ceiling, underslab rough-in installation prior to concealment.
      g. Final completion, minimum of ten (10) photos.

F. Views:

1. Provide non-aerial photographs from eight specified views at each specified time, until Date of Substantial Completion.
2. Consult with Architect for instructions on views required.
3. Provide factual presentation.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email or CD.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
5. Photo CD(s): Provide 1 copy including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.
6. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

H. Photographic Quality Prints: Full color; three prints of each view.
1. Matte; smooth texture; white tint; single weight; contrast grade 4, extra hard.
2. Size: 8 x 10 inch (200 x 250 mm); mounted for binder and tabs.
3. Identify each print on back. Identify name of Project, contract number, phase, orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.
4. Assemble prints into transparent holder sheets for 3-ring binder.
5. Binders: Provide one 2-inch binder with initial submittal.
6. Point of View Sketch: Include printed copy of point of view sketch with each submittal; include point of view identification on each print.

I. Deliver prints with each Application for Payment with transmittal letter specified in this Section.

3.07 SUBMITTALS

A. Trade Shop Drawings:
1. Trade shop drawings (i.e., fire protection sprinkler working drawings, plumbing piping system drawings, HVAC mechanical equipment room drawings, HVAC piping system drawings, HVAC sheet metal system drawings, and electrical main feeder raceway drawings) shall be submitted within (Sixty) 60 calendar days after Notice to Proceed.

B. Coordination Drawings:
1. Prepare coordination drawings according to requirements herein and in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability is necessitated.

   coordination, and if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
2. Approved trade shop drawings shall be utilized as the basis for the coordination drawings. Do not base Coordination Drawings on reproduction of Contract Documents or standard printed data.
3. Coordination drawings shall be submitted within Forty-five (45) calendar days after approval of Trade Shop Drawings.
4. Coordination drawings shall utilize electronic means of analyzing the work of each trade in spatial relationship with other trades. Locations of conflicts between trades, and the proposed resolution for each conflict, shall be noted on the coordination drawings submitted. The

intent is for the various trades to force themselves to each provide layout of their own Work on plans, review each other's layouts, and then make necessary modifications to their own respective Work until any potential conflicts are resolved.

5. No work shall be fabricated and/or installed prior to receipt by the Contractor of approved trade shop drawings and approved coordination drawings without specific written authorization from the Architect. No change orders will be approved or design assistance provided for remedial field coordination activities for work fabricated and/or installed prior to receipt by the Contractor of approved trade shop drawings and approved coordination drawings.
6. Submitted Coordination Drawings are for information only and typically will not be returned to the Contractor. Architect will not take any action but may define coordination conflicts or problems and inform the Contractor of such conflicts or problems.
7. Content:
    a. Project specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data.
    b. Show sequencing and spatial relationship of separate units of work that must function in a restricted manner to fit in the space provided, or function as indicated.
    c. Indicate dimensions shown on Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
    d. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    e. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    f. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    g. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    h. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    i. Indicate required installation sequences.
    j. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
8. Format:
    a. Coordination is to be done in 3D and presented for review in 2D.
    b. Coordination Drawings shall be drawn to a scale of not smaller than 1/4" = 1’-0”.
    c. Provide drawings on electronic media in REVIT 2022 (.rvt) format.
    d. Provide layering system separate from wall outline and unique to each consulting Discipline.
    e. In addition to plan view, provide sections as required to clarify congested situations and verify vertical clearances.
    f. One set of digital data files of Drawings for use in preparing coordination digital data files will be provided by the Architect.
        1) Base drawings in AutoCAD (.dwg) format
        2) A set of models in Revit (.rvt) format - <u>for reference only</u>
        3) Base drawings in a .pdf format scaled to 24”x36”.

g. The Architect makes no representations as to the accuracy or completeness of digital files as they relate to Drawings.
h. The Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

9. Coordination Drawing Organization: Organize coordination drawings as follows:
   a. Implement coordination drawings of all Fire Protection, Mechanical, Plumbing and Electrical into the BIM model provided by the architect. Contractor is responsible for coordinating all items noted below with all building components to prevent collisions and maintain code clearance requirements. Avoiding collisions is the responsibility of the contractor. Each Subcontractor will be responsible for submitting their BIM model to the Contractor.
   b. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
   c. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
   d. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
   e. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   f. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   g. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect or Construction Manager will so inform Contractor, who shall make changes as directed and resubmit.
   h. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Submittal Procedures.
10. HVAC Shop Drawings: Begin database as HVAC shop drawings, indicating all ductwork, piping, equipment, and location of mechanical room floor drains and electrical connections to motors. Indicate elevations and sizes of all ductwork piping.
    a. Show the following:
       1) Runs of vertical and horizontal piping 1-1/4 inches (32 mm) in diameter and larger.
       2) Sizes, shapes, and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
       3) Major components, such as dampers, valves, diffusers, access doors, cleanouts, mechanical equipment and electrical distribution equipment.
       4) Fire-rated enclosures around ductwork.
       5) All clearances above or around equipment
    b. Upon completion of HVAC shop drawings, transmit electronic database to plumbing subcontractor.
11. Plumbing Shop Drawings: Plumbing subcontractor shall add all pluming piping, controls and valves, and fixtures to database.
    a. Upon completion of Plumbing shop drawings, transmit electronic database to

fire protection subcontractor.

12. Fire Protection Shop Drawings: Fire Protection subcontractor shall add all fire protection equipment, piping, sprinkler heads, and other elements to database.
    a. Show the following:
        1) Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
        2) All equipment, panels, and pumps and required clearances.
    b. Upon completion of Fire Protection shop drawings, transmit electronic database to electrical subcontractor.
13. Electrical Shop Drawings: Electrical subcontractor shall add all electrical fixtures, conduit, and equipment to database.
    a. Show the following:
        1) Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger; two or more conduits running together requiring a rack
        2) Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
        3) Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
        4) Location of pull boxes and junction boxes, dimensioned from column center lines.
        5) All clearances above or around equipment
    b. Upon completion of Electrical shop drawings, transmit electronic database to General Contractor for final coordination.
14. General Contractor's Final Coordination: General Contractor shall thoroughly review shop drawings, adding additional building elements where appropriate, and shall resolve conflicts, coordinate with the Architect, and various subcontractors.
15. Submit Coordination Shop Drawings: Upon completion of the final coordination, General Contractor shall approve coordinate shop drawings and transmit 3 sets of hard copies and electronic files on CDs to Architect.
16. The Architect will not process sheet metal or fire protection shop drawings until such time as the coordination drawings have been sufficiently completed and conflicts resolved. This may be done on a floor-by-floor basis as a minimum.
17. No work shall be fabricated and/or installed prior to receipt by the Contractor of approved coordination drawings and trade shop drawings without specific written authorization from the Architect. No change orders will be approved or design assistance provided for remedial field coordination activities for work fabricated and/or installed prior to receipt by the Contractor of approved coordination drawings and approved trade shop drawings.

C. Record Drawings: Contractor shall provide and maintain a record set of Contract Documents in the Contractor's site office. The Contractor will update this record set on a weekly basis at a minimum, and review with the Owner's Construction Project Manager prior to issuance of a monthly certificate for payment to the Contractor. This record set shall include, but not be limited to the following:
    1. Known and intended conditions of the Work (Contract Documents) inclusive of Addenda
    2. Revisions due to:
        a. Post-bid Negotiations
        b. Field Orders
        c. Architect's Supplemental Instructions or Directives
        d. Items reported and noted by Contractor, Owner, Architect or Project Manager
    3. Verified conditions which differ from surveys, documents, records, etc.

3.08 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Refer to Section 01 6000 for detailed Product Requirements and specific Substitution procedures.

C. Contractor to review all submittals prior to forwarding to Architect. Submittals which show no evidence by Contractor to verify dimensions, fit and compliance with the Contract Documents in conjunction with field conditions will be rejected.

D. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

E. Samples will be reviewed only for aesthetic, color, or finish selection.

F. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 0 17800 - CLOSEOUT SUBMITTALS.

3.09 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

A. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches (215 x 280 mm): Submit one copy in electronic (PDF) format.
   1. Architect shall review and return one reviewed, marked copy to the contractor

B. Larger Sheets, Not Larger Than 36 x 48 inches (910 x 1220 mm): Submit one copy in electronic PDF format.
   1. Architect shall review and return one reviewed, marked copy to the contractor

C. Documents for Information: Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Architect, and two copies for the Owner.

D. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit formed plastic extra of submittals for information.

E. Samples: Submit the number specified in individual specification sections; one of which will be retained

by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

A. Number submittals based on specification section Sequence - add alphabetical suffix sequentially for each submittal within specification section.

B. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

C. 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 the requirements of the Work and Contract Documents.

D. Deliver submittals to the Architect's business address.

E. Electronic transmission of .pdf files for various submittals may be possible depending on the nature (size, number of pages, etc.) of each submittal, and can be coordinated with the Architect on a case-by-case basis. In the event a transmittal is agreed to be reviewed and processed electronically, the Contractor shall provide the required number of hard copies to the Owner and Architect for record after receiving the approved submittal.

F. Schedule: Schedule submittals to expedite the Project, and coordinate submission of related items. See additional provisions outlined in Paragraph 3.03 above.

G. Review: For each submittal for review, allow Twenty-one (21) Calendar days for review by the Architect, exclusive of delivery time to and from Contractor. Submittals received after 2:00 pm shall be dated as received the following business day. Likewise, submittals received after 2:00 pm on a Friday shall be dated as received the following Monday. In each case the adjusted date of receipt shall represent the commencement of the Twenty-one (21) calendar day review period. For submittals which include significant number of sheets, or require review for coordination with submittals of related Work, additional time shall be required for review. Architect will advise Contractor of additional time required.

H. Exterior Finishes Bundled Submittals: Within Sixty (60) calendar days or before of Notice to Proceed, the Contractor is to group and submit all exterior finish selection submittals together for the Architect to review and verify selections with the Owner and provide a date the finish selections are needed to maintain the project schedule, providing a minimum of 30 days for review, verification, and approval with the Owner. These finishes shall include, but not be limited to: Stone, precast concrete, curtainwall, glazing, metal panels, metal roofing, sealant.

I. Interior Finishes Bundled Submittals: Within Sixty (60) calendar days of Notice to Proceed, the Contractor is to group and submit all interior finish selection submittals together for the Architect to review and verify selections with the Owner, and provide a date the finish selections are needed to maintain the project schedule, providing a minimum of Thirty (30) calendar days for review, verification and approval with the Owner. These finishes shall include, but not be limited to: Paint, wall base, flooring, ceiling tile, millwork/casework, light fixtures, and plumbing fixtures.

J. Provide space for Contractor and Architect review stamps.

K. When revised for resubmission, identify all changes made since previous submission.

L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

N. Submittals of proposed substitutions not complying with Section 01 6000 will not be recognized or processed.

3.13 REQUESTS FOR INFORMATION (RFI)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.
   9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   10. Contractor's signature.
   11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: Approved Form.
   1. Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow a minimum of seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. shall be considered as received the following working day. RFIs received after 12:00 Noon on a Friday shall be considered as received the following Monday and shall be recorded in the RFI Log reflecting the same date received.
   1. The following RFIs will be returned without action and shall be removed from the RFI Log:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents, or which is the responsibility of the respective contractors to develop in the first place.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFIs or RFIs with numerous errors.
   2. RFI form, or RFI shall contain no language referencing the contactor's "reserved right" to receive additional time or compensation based upon information provided by the Architect, or Engineer.
   3. Architect's action may include a request for additional information, in which case Architect's time for response will restart to Seven (7) calendar days .

4. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify the Architect in writing within Ten (10) calendar days of receipt of the RFI response.
5. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify the Architect within three calendar days if Contractor disagrees with response.

F. RFI's returned to the contractor for revision requiring additional information or clarification shall not appear in the RFI log as "Unanswered", or "Overdue".

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly including not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Project Manager.
4. RFI number including RFIs that were voided and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architects and Construction Manager's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

3.14 ELECTRONIC FILE TRANSFER

A. Electronic (CAD) drawing files and Revit Coordination Model can be provided on a specific requested basis from the General Contractor or their subcontractor on a case-by-case basis during construction, but not during bidding.

B. Requests should be made on an individual basis directly to the architect or engineer for their respective drawing(s) in Electronic format (Revit. Each engineer and the architect have an 'Electronic File Transfer Agreement' form to be filled out and signed by the individual or company making the request. Any requests should be made directly to the respective engineer or architect for their drawing(s), and shall include the signed Agreement, along with a specific list of requested drawings. The Electronic File Transfer Agreements will be provided to the successful bidder upon execution of the Contract.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance submittals.

B. Contractor Quality Assurance System

C. Control of installation.

D. Tolerances.

E. Contractor Employed Testing and Inspection Agency services.

F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Geotechnical Report

B. Document - General Conditions: Inspections and approvals required by public authorities.

C. Section 01 3100 - Administrative Requirements: Submittal procedures.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2013a.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2012.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2011.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009.

1.04 CONTROL SYSTEM

A. The Contractor shall establish and maintain a system for documenting, monitoring, inspecting, verifying, and testing of the work and that of his subcontractors to ensure that all applicable requirements of the contract documents are met.

B. The Contractor shall be diligent to ensure that the quality of workmanship is satisfactory, that the installation meets all manufacturer requirements, that dimensional requirements are met, that defective materials are not used, and that all required protection and control and laboratory testing procedures are affected. Where specific testing procedures are not stipulated, the Contractor shall establish and conduct a test procedure to ensure adherence to specified quality.

1.05 CHAIN OF CONTROL

A. The Contractor shall plan, coordinate, execute, and examine the work to ensure the complete, workmanlike, and warrantable installation of all materials in a system or element of the construction.

B. Additionally, the Contractor shall plan, coordinate, execute, and examine the work to ensure that all underlying, substrate, or contiguous work is installed as required to meet the tolerances and requirements for the correct installation of subsequent work.

1. Furthermore, it is the responsibility of the Contractor to advise the Architect no later than the submittal phase of any discrepancies in the requirements or tolerances of materials or components in a system or element of the construction.

1.06 SUBMITTALS

A. QA / QC Program

1. Documentation: The format shall be by specification section or by system or element of the construction. The documentation shall be organized in a comprehensive and collated manner to ensure ease of use and reference. A Table of Contents shall be included.
2. The Contractor's system shall include, but is not limited to the following:
    a. Inspection and Testing requirements.
    b. Schedule including required inspections.
    c. Requirements and tolerances of underlying, substrate, or contiguous work.
    d. Specifications
    e. Submittals
    f. Test Results
    g. Manufacturer's Recommendations, Requirements, and Instructions
    h. Packaging labels from Materials where possible
    i. Periodic, Dated Photos of the work being performed and any other documentation that pertains to the warranty of the material or structure
    j. Samples of the material when reasonable
    k. Submittal of QA / QC Program:
        1) The Contractor shall submit for Owner's Approval their program format 10 (ten) days from Notice to Proceed.
    l. Closeout Requirements: The Document Record generated by the QA / QC process is to be submitted as part of the required closeout documents.
3. Testing Agency Qualifications:
    a. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
    b. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
4. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the concept expressed in the contract documents, or for Owner's information.
5. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
    a. Include:
        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 the Project.
        7) Type of test/inspection.
        8) Date of test/inspection.
        9) Results of test/inspection.
        10) Conformance with Contract Documents.
    b. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
6. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

a. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
b. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

7. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.07 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing and special inspections.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, and ASTM C1093.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
3. Laboratory: Authorized to operate in Alabama.
4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 QA / QC PROGRAM REQUIREMENTS

A. Inspections: The Contractor shall make an initial inspection of each phase of work as soon as a representative portion has been completed, and the Contractor shall make follow-up inspections as required, to ensure that an acceptable quality of work is established and maintained.
1. The Contractor shall perform a pre-final inspection, prepare a punch list, and work off all items prior to A/E inspection. Contractor shall provide copy of completed report, certifying it's completion to the Architect prior to the Architect beginning his inspections.
2. The Contractor shall coordinate and plan inspections by the Architect and Awarding Authority in a timely manner to ensure that all parties can be scheduled so as not to impede the flow of the work.

3.02 CONTROL OF INSTALLATION

A. 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.

B. Have Work performed by persons qualified to produce required and specified quality.

C. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

3.03 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. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 01 4000

SECTION 01 4100 – STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Attachment F, Contractor's Statement of Responsibility for Construction of Safe Spaces.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections as well as specific quality-assurance and -control requirements for individual construction activities as referenced in the Sections that specify those activities. Section further includes administrative and procedural requirements required for compliance with the International Code Council's ICC 500-08 Standard for the Design and Construction of Storm Shelters, Special Inspections, quality-assurance plan and Contractor responsibility.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities or herein. Requirements in those Sections or herein may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.

3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:

1. 02300 EARTHWORK

2. 03300 CAST-IN-PLACE CONCRETE.

3. 04810 UNIT MASONRY ASSEMBLIES.

4. 05120 STRUCTURAL STEEL.

5. 05210 STEEL JOISTS.

6. 05310 STEEL DECK.

7. 05400 COLD-FORMED METAL FRAMING.

1.3 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official and the Structural Engineer of Record.

B. Construction Documents: Written (including specifications), graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.

    a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

2. Additional minimum qualifications of inspection and testing agencies and their personnel inspecting and testing concrete and concrete related work shall be as follows:

    a. An independent agency, acceptable to the Structural Engineer of Record qualified according to ASTM C 1077.

b. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

c. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

3. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. 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 to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:

a. Date of inspection.

b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).

c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.

1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.

d. Name and signature of special inspector and / or testing agency representative performing the work.

e. Additional information as required herein.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Concrete Test Reports: Test results shall be reported in writing to Architect, Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain:

1. Project identification name and number.

2. Date and time of concrete placement.

3. Mix design number or identification.

4. Design compressive strength at 28 days.

5. Design Air Content.

6. Design Slump.

7. Location of concrete batch in Work.

8. Time concrete was batched.

9. Amount of water withheld at plant.

10. Amount of water added at site.

11. Temperature of mix at point of placement.

12. Slump at point of placement

a. When use of a Type I or II plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C494 is used, slump shall be measured and report both before addition of the admixture and at the point of placement.

13. Air content.

14. Name of concrete testing and inspecting agency.

a. Name of Laboratory Technician and ACI Certification Number.

b. Name of Field Technician and ACI Certification Number.

15. Compressive breaking strength.

16. Type of break.

E. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.

B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.

2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.

3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.

4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

D. Each contractor responsible for the construction of a main windforce-resisting system or a wind-resisting component or shelter main wind force-resisting system or a shelter wind-resisting component shall listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.

2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.

3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.

4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

E. The contractor shall also coordinate the Structural Observations of the registered design professional to conduct visual observations of the construction of structural elements and shelter structural systems as follows:

1. Shelter: prior to first wall concrete placement with one side of forms in place

2. Shelter: first roof concrete placement with reinforcing in place

F. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.

1. Contractor shall prepare repair and / or replacement procedures.

2. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

G. The contractor shall be responsible for costs of:

1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.

2. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

B. Structural observations of storm shelters' structural system shall be for general conformance to the approved construction documents at significant construction stages and at completion of the construction of the structural system. Structural observation shall not obviate the need for other inspections or testing required by this specification or the applicable building code.

3.3 TESTING AND INSPECTION SCHEDULE

A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections, as listed elsewhere in the project documents, and as listed herein.

B. Inspection of Fabricator's QC procedures

1. Review the quality control procedures of the following fabricators for completeness and adequacy relative to the fabricator's scope of work: steel fabricator, steel joist fabricators and precast fabricators.

i. Exception: AISC Certified Steel Fabricators that submit a "Certificate of Compliance" at completion of their scope of work.

C. Soil Supported Foundations, Periodic Inspection.

1. Verify bearing capacities of soils beneath footings is in accordance with the approved project soils report and earthwork specifications.

2. Verify assumed bearing capacities (As noted on the drawings, recommended by the geotechnical engineer, and specified in earthwork specifications.) and determine settlements of soils beneath footings and building pad.

3. Verify site preparation prior to beginning fill placement. Verify fill material type, placement method, lift thickness, and compaction of fill material. Verify in-place density of compacted fill.

    i. As recommended in approved soils report and specified in earthwork specifications.

D. Concrete, Continuous Inspection

1. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

    i. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd, but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    ii. 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. Slump: ASTM C 143; 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.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

    i. Unit Weight is only required for lightweight concrete

6. Compression Test Specimens: ASTM C 31:

    i. Cast and laboratory cure four standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimens at 7 days, one set of two specimens at 28 days, and hold one in reserve for later testing as directed by the Structural Engineer of Record.

    i. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

8. Inspect bolts to be installed prior to and during placement of concrete.

9. Inspect concrete placement to verify operations are in accordance with project requirements.

    i. Verify correct mix is used.

10. Observe and record application of prestressing forces. Measure tendon elongations. Report condition of wedges and anchorages.

11. Observe grouting of bonded prestressing tendons.

E. Concrete, Periodic Inspection

1. Floor flatness:

i. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

2. Inspect concrete formwork prior to concrete placement, except as noted. Verify that construction joints are properly keyed. Verify that slab recesses, if any, have been installed.

3. Inspect reinforcing steel prior to concrete placement, except as noted, for installation including size, spacing and bar clearances. Verify that lap splices and embedment lengths are per the construction documents. Verify that dowels for work above are properly aligned and spaced to match other work.

4. Inspect all concrete curing operations and verify they are in accordance with project requirements.

F. Steel Construction, Continuous Inspection

1. Inspect welding: Structural Steel:

i. Complete and partial penetration groove

1. Perform Continuous Inspection during the Welding Operations to verify compliance with approved WPS.

2. All Complete and partial penetration groove shall be non-destructively tested using the most appropriate (according to AWS D1.1 and AWS B1.10 recommendations and as approved by the Structural Engineer of Record) method from the following:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not to be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94

3. All Complete and partial penetration groove shall additionally be visually inspected.

ii. Multipass fillet welds.

1. Perform Continuous Inspection during the Welding Operations to verify compliance with approved WPS.

iii. Single-pass fillet welds > 5/16

1. Perform Continuous Inspection during the Welding Operations to verify compliance with approved WPS.

G. Steel Construction, Periodic Inspection

1. Inspect high-strength bolts, nuts and washers:
    i. Identify markings to conform to ASTM standards specified in the construction document.
    ii. Inspect manufacturer's certificate of compliance.
2. Inspect high-strength bolting: Bearing-type connections.
3. Inspect and verify structural steel material:
    i. Identification markings to conform to ASTM standards specified in the approved construction documents.
    ii. Manufacturers' certified mill test reports.
4. Inspect and verify weld filler materials:
    i. Identification markings to conform to AWS specification in the approved construction documents.
    ii. Manufacturer's certificate of compliance required
5. Inspect welding: Structural Steel:
    i. Single-pass fillet welds ≤ 5/16
    ii. Floor and deck welds.
6. Inspect steel frame joint details for compliance with approved construction documents:
    i. Details such as bracing and stiffening.
    ii. Member locations.
    iii. Application of joint details at each connection.
7. Shapes and Plates in Welded Moment Connections
    i. Visually inspect for laminations before and after welding all joints (regardless of plate thickness) where material is subjected to tension in the thru-thickness direction.
8. Verify all welds in moment and braced frames (beams, columns, braces, and connection material) shall be made with a filler metal that can produce welds that have a minimum Chary V-Notch toughness of 20 ft-lbf at minus 20 deg F, as determined by AWS classification or manufacturer certification.
9. Verify the following CJP welds in moment frames are made with filler material capable of providing a minimum Charpy V-Notch toughness of 20 ft-lbf at minus 20 deg F as determined by AWS classification test methods and 40 at 70 deg F as determined by Appendix X of the AISC (2002) "Seismic Provisions for Structural Steel Buildings."
    i. Welds of beam flanges to columns
    ii. Grove welds of shear tabs and beam webs to columns
    iii. Column splices

10. Verify Steel Backing, Weld Tabs, and Tack Welds are in accordance with Specification Section 05120.

PART 4 - SCHEDULES AND FORMS (ATTACHED)

4.1 STATEMENT OF SPECIAL INSPECTIONS.

4.2 FABRICATOR'S CERTIFICATE OF COMPLIANCE

4.3 QUALITY ASSURANCE PLAN

4.4 QUALITY ASSURANCE PLAN – STORM SHELTER

4.5 CONTRACTOR'S STATEMENT OF RESPONSIBILITY

4.6 CONTRACTOR'S STATEMENT OF RESPONSIBILITY – STORM SHELTER

4.7 SCHEDULE OF SPECIAL INSPECTIONS.

4.8 FINAL REPORT OF SPECIAL INSPECTIONS.

END OF SECTION 01 4100

STATEMENT OF SPECIAL INSPECTIONS

Project:

Project Address:

Permit Applicant:

Applicant Address:

Owner:

Owner Address:

Registered Design Professionals (RDP):

Architect:

Geotechnical Engineer:

Structural Engineer: Structural Design Group, Inc.

Mechanical Engineer:

Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a *Schedule of Special Inspections* 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.

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 permit applicant and 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 correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than weekly.

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.

Owner's Acknowledgement:

Signature Date

RDP in Responsible Charge

Building Official's Acceptance:

Signature Date

Permit No.

Frequency of interim report submittals to building official:

☐ Monthly ☐ Bi-Monthly ☐ Upon Completion ☐ Per Attached Schedule

FABRICATOR'S CERTIFICATE OF COMPLIANCE

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

_____ _____
Signature Date

_____
Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

QUALITY ASSURANCE PLAN

Quality Assurance for Seismic Resistance

Seismic Design Category	*B*
Quality Assurance Plan Required (Y/N)	*NO*

Description of seismic force resisting system and designated seismic systems:
N/A

Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust)	*113*
Wind Exposure Category	*C*
Quality Assurance Plan Required (Y/N)	*YES*

Description of wind force resisting system and designated wind resisting components:
Reinforced concrete moment frames and steel concentrically braced frames.

Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility.

CONTRACTOR'S STATEMENT OF RESPONSIBILITY

Each contractor responsible for the construction or fabrication of a system or component designated in the Quality Assurance Plan must submit a Statement of Responsibility.

Project:

Contractor's Name:

Address:

License No.:

Description of designated building systems and components included in the Statement of Responsibility:
Reinforced concrete building structure and steel concentrically braced frames.

Contractor's Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Quality Assurance Plan and Special Inspection program.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

_____ _____
Signature Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the 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.

FINAL REPORT OF SPECIAL INSPECTIONS

Project:

Project Address:

Testing / Inspection Agent:

Testing / Inspection Agent Address:

Scope of Testing / Inspections:

(To be completed by Testing / Inspection Agent)

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the *Schedule of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

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" x 11" continuation sheet(s) if required to complete the description of corrections)

Special Inspector's Seal

Prepared By:

_____

Type or print name

_____

Signature Date

(Licensed Professional Engineer)

SCHEDULE OF SPECIAL INSPECTIONS

Item	Inspection / Test / Certification	C or P	Extent / Comments	Agent
1.00	**Fabricators**			
1.01	Review the quality control procedures of the following fabricators for completeness and adequacy relative to the fabricator's scope of work: steel fabricator, lightgage truss fabricator, wood truss fabricator.	Periodic		OTA
1.02	The following fabricators, if registered and approved by the building official, may submit "Certificates of Compliance" at the completion of their scope of work that their fabricated items were constructed in accordance with the approved construction documents: steel fabricator, lightgage truss fabricator, wood truss fabricator.	Periodic		OTA
2.00	**Soils and Deep Foundations**			
2.01	Verify bearing capacities of soils beneath footings.	Periodic	As recommended in approved soils report and specified in earthwork specifications.	OTA
2.03	Verify site preparation prior to beginning fill placement. Verify fill material type, placement method, lift thickness, and compaction of fill material. Verify in-place density of compacted fill.	Periodic	As recommended in approved soils report and specified in earthwork specifications.	OTA
2.04	Inspect installation of pile foundations including installation of test piles.	Continuous	As recommended in approved soils report and specified in pile specifications.	OTA
2.05	Inspect installation of drilled pier foundations and installation of test piers. Inspect reinforcing in each pier and test concrete.	Continuous	As recommended in approved soils report and specified in pile specifications.	OTA
3.00	**Concrete Construction**			

Item	Inspection / Test / Certification	C or P	Extent / Comments	Agent
3.01	Inspect concrete formwork except as noted above for proper dimensions. Verify that construction joints are properly keyed. Verify that slab recesses, if any, have been installed.	Periodic	Prior to each pour.	OTA
3.02	Inspect reinforcing steel except as noted above for installation including size, spacing and bar clearances. Verify that lap splices and embedment lengths are per the construction documents. Verify that dowels for work above are properly aligned and spaced to match other work.	Periodic	Prior to each pour.	OTA
3.03	Inspect bolts	Periodic		OTA
3.04	Inspect bolts to be installed in concrete prior to and during placement of concrete.	Continuous	During placement and concreting operations.	OTA
3.05	Verify each proposed concrete mix for the project.	Periodic	For each proposed mix.	OTA
3.06	Sample all concrete for strength tests and test concrete for slump, air content, temperature, and other tests.	Continuous	During placement operations. Reference concrete specifications for specific tests and frequencies.	OTA
3.07	Inspect concrete placement except as noted above.	Continuous		OTA
3.08	Inspect all concrete curing operations as noted in the extents column.	Periodic	Monitor during hot, cold and windy conditions. Reference concrete specifications.	OTA
3.09	Verification of in-situ concrete strength prior to backfilling walls.	Periodic	Prior to backfilling operations.	OTA
4.00	**Maosonry Construction**			
4.01	Masonry foundation walls are excluded from inspections listed below.			OTA
4.02	Inspect masonry cells and cleanouts prior to placement of grout. Inspect grout proportions. Inspect placement of reinforcement.	Periodic	Prior to grouting of masonry.	OTA
4.03	Inspect grouting operations to ensure compliance with code and construction documents.	Continuous	During grouting.	OTA

Item	Inspection / Test / Certification	C or P	Extent / Comments	Agent
4.04	Inspect proportions of site prepared mortar and grout. Inspect placement of masonry units and construction of mortar joints. Inspect reinforcement for correct size and spacing. Inspect work for correct size and location of structural elements.	Periodic	At beginning of masonry construction and every 1000 square feet of masonry thereafter.	OTA
4.05	Inspect type size and location of anchors, including details of anchorage of masonry to structural members, frames or other construction.	Continuous	During installation of anchors.	OTA
4.06	Inspect protection of masonry during cold weather and hot weather.	Periodic	During periods with temperatures below 40 degrees or above 90 degrees.	OTA
4.07	Inspect preparation of grout specimens, mortar specimens and / or prisms.	Continuous	During preparation of all specimens.	OTA
4.08	Verify compliance with all required inspection provisions of the construction documents and approved submittals.	Periodic	As required for duration of project.	OTA
5.00	**Steel Construction**			
5.01	Inspect high-strength bolts, nuts and washers: a. Identify markings to conform to ASTM standards specified in the construction documents. b. Inspect manufacturer's certificate of compliance.	Periodic	Reference project specifications and ASTM material specifications; AISC 335, (Sect A3.4); AISC LRFD (Sect A3.3).	OTA
5.02	Inspect high-strength bolting: Bearing-type connections.	Periodic		OTA
5.03	Inspect high-strength bolting: Slip-critical connections.	Periodic or Continuous	Continuous monitoring required for pretensioning using calibrated wrench method or turn-of-nut method without matchmarking.	OTA
5.04	Inspect and verify structural steel material: a. Identification markings to conform to ASTM standards specified in the approved construction documents. b. Manufacturers' certified mill test reports.	Periodic	Confirm that materials meet applicable ASTM specifications noted in construction documents.	OTA
5.05	Inspect and verify weld filler materials: a. Identification markings to conform to AWS specification in the approved construction documents. b. Manufacturer's certificate of compliance required.	Periodic	Confirm that materials meet applicable ASTM specifications noted in construction documents.	OTA
5.06	Inspect welding: Structural Steel: 1) Complete and partial penetration groove 2) Multipass fillet welds. 3) Single-pass fillet welds > 5/16 ″	Continuous	Per specifications and AWS D1.1	OTA

Item	Inspection / Test / Certification	C or P	Extent / Comments	Agent
5.07	Inspect welding: Structural Steel: 1) Single-pass fillet welds ≤ 5/16 ″ 2) Floor and deck welds.	Periodic	Per specifications and AWS D1.1	OTA
5.08	6. Inspect steel frame joint details for compliance with approved construction documents: a. Details such as bracing and stiffening. b. Member locations. c. Application of joint details at each connection.	Periodic	Inspect complete frame.	OTA
6.00	**Special Inspections for Wind Resistance**			
6.01	Roof Cladding and Roof Framing Connections	Periodic		OTA
6.02	Wall Connections to Roof and Floor Diaphragms and Framing	Periodic		OTA
6.03	Roof and Floor Diaphragm Systems, including Collectors, Drag Struts, and Boundary Elements.	Periodic		OTA
6.04	Vertical Windforce-Resisting Systems, including Braced Frames, Moment Frames, and Shearwalls	Periodic		OTA
6.05	Windforce-Resisting System Connections to the Foundation.	Periodic		OTA
6.06	Fabrication and installation of components and assemblies required to meet the impact-resistance requirements of Section 1609.1.4.	Periodic		OTA
7.00	**Cold Formed Steel Framing Construction**			
7.01	Inspect exterior wall infill including installed studs' sizes and attachments.	Periodic		OTA
7.02	Inspect roof trusses assembly/framing and attachments.	Periodic		OTA
7.03	Verify framing spacing, configuration and attachments.	Periodic		OTA
7.04	Verify bracing and blocking	Periodic		OTA
7.05	Proper seating of studs in track.	Periodic		OTA
7.06	Stud header size, gauge, and construction per structural drawings for load bearing walls.	Periodic		OTA

Item	Inspection / Test / Certification	C or P	Extent / Comments	Agent
7.07	Screw attachments, bolting, anchoring, and other fastening of components per structural drawings.	Periodic		OTA
7.08	Welding of elements per structural drawings.	Periodic		OTA
7.09	Where a cold-formed steel truss clear span is 60 feet or greater, verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.	Periodic		OTA

INSPECTION AGENTS

#	Firm, Address, Telephone
SDG	**300 Chase Park South, Suite 125 Hoover, AL 35244 205-824-5200**
OTA	**Owner's Testing Agent**

Note: 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 Inspection Agent(s) may be subject to the approval of the Building Official.

Is the Schedule of Special Inspection Services part of a Quality Assurance Plan as defined in Sections 1705 or 1706 of the Building Code? _____

SECTION 01 4216

DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

G. Architect: The Architect is the person or entity lawfully licensed to practice architecture in the State of the Project location, who is under contract with the Owner as the primary design professional for the Project and identified as the Architect in the Construction Contract. The term “Architect” means the Architect or the Architect's authorized representative. If the employment of the Architect is terminated, the Owner shall employ a new Architect whose status under the Contract Documents shall be that of the former Architect. If the primary design professional for the Project is a Professional Engineer, the term “Engineer” shall be substituted for the term “Architect” wherever it appears in this document.

H. Contract: The Contract is the embodiment of the Contract Documents. The Contract represents the entire and integrated agreement between the Owner and Contractor and supersedes any prior written or oral negotiations, representations or agreements that are not incorporated into the Contract Documents. The Contract may be amended only by a Contract Change Order or a Modification to the Construction Contract. The contractual relationship which the Contract creates between the Owner and the Contractor extends to no other persons or entities. The Contract consists of the following Contract Documents, including all additions, deletions, and modifications incorporated therein before the execution of the Construction Contract:

1. Construction Contract
2. Performance and Payment Bonds
3. Conditions of the Contract (General, Supplemental, and other Conditions)
4. Specifications
5. Drawings
6. Contract Change Orders
7. Modifications to the Construction Contract (applicable to PSCA Projects)

I. Contract Sum: The Contract Sum is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. The term “Contract Sum” means the Contract Sum stated in the Construction Contract as may have been increased or decreased by Change Order(s) in accordance with the Contract Documents.

J. Contract Time: The Contract Time is the period of time in which the Contractor must achieve Substantial Completion of the Work. The date on which the Contract Time begins is specified in the

written Notice To Proceed issued to the Contractor by the Owner . The Date of Substantial Completion is the date established in accordance with the General Conditions. The term “Contract Time” means the Contract Time stated in the Construction Contract as may have been extended by Change Order(s) in accordance with the Contract Documents. The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

K. Contractor: The Contractor is the person or persons, firm, partnership, joint venture, association, corporation, cooperative, limited liability company, or other legal entity, identified as such in the Construction Contract. The term “Contractor” means the Contractor or the Contractor's authorized representative.

L. Defective Work: The term “Defective Work” shall apply to: (1) any product, material, system, equipment, or service, or its installation or performance, which does not conform to the requirements of the Contract Documents, (2) in-progress or completed Work the workmanship of which does not conform to the quality specified or, if not specified, to the quality produced by skilled workers performing work of a similar nature on similar projects in the state, (3) substitutions and deviations not properly submitted and approved or otherwise authorized, (4) temporary supports, structures, or construction which will not produce the results required by the Contract Documents, and (5) materials or equipment rendered unsuitable for incorporation into the Work due to improper storage or protection.

M. Drawings: The Drawings are the portions of the Contract Documents showing graphically the design, location, layout, and dimensions of the Work, in the form of plans, elevations, sections, details, schedules, and diagrams.

N. Notice to Proceed (NTP): A proceed order issued by the Owner or Director, as applicable, fixing the date on which the Contractor shall begin the prosecution of the Work, which is also the date on which the Contract Time shall begin.

O. Owner: The Owner is the entity or entities identified as such in the Construction Contract and is referred to throughout the Contract Documents as if singular in number. The term “Owner” means the Owner or the Owner's authorized representative. The term “Owner” as used herein shall be synonymous with the term “Awarding Authority” as defined and used in Title 39 - Public Works, Code of Alabama, 1975, as amended.

P. The Project: The Project is the total construction of which the Work required by these Contract Documents may be the entirety or only a part with other portions to be constructed by the Owner or separate contractors.

Q. Project Manual : The Project Manual is the volume usually assembled for the Work which may include the Advertisement for Bids, Instructions to Bidders, sample forms, General Conditions of the Contract, Supplementary Conditions, and Specifications of the Work.

R. Specifications: The Specifications are that portion of the Contract Documents which set forth in writing the standards of quality and performance of products, equipment, materials, systems, and services and workmanship required for acceptable performance of the Work.

S. Subcontractor: A Subcontractor is a person or entity who is undertaking the performance of any part of the Work by virtue of a contract with the Contractor. The term “Subcontractor” means a Subcontractor or its authorized representatives.

T. The Work: The Work is the construction and services required by the Contract Documents and includes all labor, materials, supplies, equipment, and other items and services as are necessary to produce the required construction and to fulfill the Contractor's obligations under the Contract. The Work may constitute the entire Project or only a portion of it.

U. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of

any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4216

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Traffic Control Plan: Submit Site plan layout indicating and locating the following:

1. Access points.
2. Fencing and Gates.
3. On Site parking.
4. Loading / Staging / Storage / Stockpiles.
5. Field Offices.
6. Informational and control signage.
7. Barricades.

1.04 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes and field offices.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS AND SIGNAGE

A. Provide adequate directional and informational signage as well as personnel to maintain safe and orderly conditions for public vehicular and pedestrian traffic.

B. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

C. Provide barricades and other protection required by governing authorities for public rights-of-way .

D. Provide protection for plants designated to remain. Replace damaged plants.

E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

A. See Architectural Phasing Plan.

1.09 SECURITY

A. Provide security and facilities to protect Work, Equipment, material and Construction Manager's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING

A. Provide adequate means for maintaining safe and orderly regulation of public vehicular traffic around the Site.

B. Coordinate access and haul routes with governing authorities and Construction Manager.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Existing, adjacent, or nearby parking areas may not be used for construction parking.

H. Designate one parking space for Owner and Architect use.

1.11 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 6 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Lists of products to be removed from existing building.

B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

C. Section 01 4000 - Quality Requirements: Product quality monitoring.

D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.

B. CAN/CSA Z809 - National Standard for Sustainable Forest Management; CSA International Inc; 2008.

C. NEMA MG 1 - Motors and Generators; 2014.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within Fifteen (15) calendar days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
   1. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Made outside the United States, its territories, Canada, or Mexico.
   2. Made using or containing CFC's or HCFC's.
   3. Made of wood from newly cut old growth timber.

C. Where other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste. See Section 01 7419
   4. Are made of vegetable materials that are rapidly renewable.

D. Joint Sealants, Including Duct Sealers:
   1. Provide only products having lower volatile organic compound (VOC) content than required by Bay Area Air Quality Management District Regulation 8, Rule No.51.
      a. Require each installer to certify compliance and submit product data showing product content.
   2. Specific Product Categories: Comply with limitations specified elsewhere.

E. Provide interchangeable components by the same manufacture for components being replaced.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

G. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

F. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

G. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

H. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

I. Section 07 8400 - Firestopping.

j. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
   1. Minimum of Five (5) years of documented experience.

B. For surveying work, employ a land surveyor registered in Alabama and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Alabama. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Alabama.

1.05 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: 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. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated 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.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. 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.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that 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. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 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 any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four (4) business days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two (2) business days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 01 1000 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment ; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Clean existing systems and equipment.

H. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

I. Do not begin new construction in alterations areas before demolition is complete.

J. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a 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 the space.

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 trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative 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 that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous and approved for use by manufacturers of products to be cleaned.

C. 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.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, 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 Substantial Completion inspection.

E. Owner will occupy all of the building as specified in Section 01 1000.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Accompany Project Coordinator on Contractor's preliminary final inspection.

I. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

J. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION 01 7000

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
   8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
   9. Asphalt paving: May be recycled into paving for project.
   10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   11. Glass.
   12. Gypsum drywall and plaster.
   13. Plastic buckets.
   14. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   15. Paint.
   16. Plastic sheeting.
   17. Rigid foam insulation.
   18. Acoustical ceiling tile and panels.

E. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.
   5. Incineration, either on- or off-site.

F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures.

B. Section 01 3100 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 01 6000 - Product Requirements: Waste prevention requirements related to product substitutions.

E. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

F. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

G. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.
   4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
   5. Locate enclosures out of the way of construction traffic.
   6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 7419

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 6104 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents Fifteen (15) calendar days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within Ten (10) calendar days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within Ten (10) calendar days after acceptance.
   2. Make other submittals within Ten (10) calendar 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 (10) calendar days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. Contractor shall submit Two (2) thumb drives, or equal, containing all drawings (shop, final, redlined), Submittals, Operational and Maintenance Manuals, and Warranties and Bonds

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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.

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 and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first 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.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

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 any 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. Provide 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. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, 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 special 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 and bonds.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 7800

SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than two weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.

2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: Thumb drive or equal.
2. Label each disc and container with session identification and date.

F. Aquatics Operations Manual
1. The general contractor shall provide a complete operation manual for the aquatic facility. This document shall include:
a. parts lists and installation information
b. step-by-step instructions for operations and troubleshooting for all equipment
c. a list of manufacturers with their respective telephone numbers.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two (2) weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.

3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three (3) business days.

END OF SECTION 01 7900

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 05 5100 – Metal Stairs.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Concrete fill for Metal Pan Stair Tread and Landings.
   7. Building frame members.
   8. Building walls.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Shrinkage Resistant Concrete (hereafter SRC): SRC is normal weight concrete including Eclipse Floor 200 shrinkage reducing admixture produced by Grace Construction Products.

1.4 SUBMITTALS

A. Shop Drawings, General:
   1. Submit all shop drawings electronically. Electronic copies will be returned to the Architect. Reproductions required by the Contractor are the responsibility of the Contractor and shall be made after electronic copy is returned.
   2. The contractor shall fill out the Concrete Submittal Checklist and include it as part of his mix design and/or shop drawing submittal package(s). Submittals without the checklist will be returned unchecked as an incomplete submittal. The checklist sheet is located at the end of this specification section.
      a. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the checklist. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the checklist and subsequently not explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.
   3. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
   4. Contract documents shall not be used for shop drawing, including erection plans or details.

B. Product Data: For each type of product indicated.

C. Design Mixtures: Prepare design mixes for each type and strength of concrete by either laboratory trial mixtures or field experience methods as specified in ACI 318-14 Section 5.3. If trial mixtures method

used, the contractor is to provide and use an independent testing facility for preparing and reporting proposed mix designs.

1. All concrete mix designs shall include the following information:
    a. Proportions of cement, fine and coarse aggregate and water.
    b. Water/cement ratio, design strength, slump and air content.
    c. Type of cement and aggregates.
    d. Type and dosage of all admixtures.
    e. Type, color and dosage of integral coloring compounds, where applicable.
    f. Special requirements for pumping.
    g. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.
    h. Dated test data for the laboratory trial mixture or filed experience method.
    i. Material certifications (materials shall meet the requirements of section 2.5 below:
        1) Cementitious materials.
        2) Admixtures.
        3) Aggregates.

2. Submit written reports to Architect and Structural Engineer of Record of each proposed mix for ea
3. ch class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed and approved by Architect and Structural Engineer of Record.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Samples: Submit samples of materials as requested by Architect, including names, sources, and descriptions for waterstops, vapor retarder and other products indicated by Architect.

F. Welding certificates.

G. Qualification Data: For Installer, manufacturer and testing agency.

H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
    1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Material Certificates: For each of the following, signed by manufacturers:
    1. Cementitious materials.
    2. Admixtures.
    3. Form materials and form-release agents.
    4. Steel reinforcement and accessories.
    5. Fiber reinforcement.
    6. Waterstops.
    7. Curing compounds.
    8. Floor and slab treatments.
    9. Bonding agents.
    10. Adhesives.
    11. Vapor retarders.
    12. Semirigid joint filler.
    13. Joint-filler strips.
    14. Repair materials.

J. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

K. Field quality-control test and inspection reports.

L. Minutes of pre-installation conference.

M. Slab Stud-Shear reinforcement
   1. The contractor shall provide detailed shop drawings of the slab stud shear reinforcement. Shop drawings shall include:
      a. Dimensioned details and configuration of each rail
      b. Color assigned to each rail configuration (each rail shall be color coded for easy field identification)
      c. A plan layout indicating the location of each configuration of rail.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. The Owner shall employ an approved Testing Agency to perform concrete and concrete related tests and inspections (that are not specifically noted as the contractor’s responsibility) as required by the Building Code, Project Documents, the Architect, and the Structural Engineer of Record.

E. The contractor shall employ at his expense an approved Testing Agency as defined above to perform the following:
   1. Evaluation of trial mixtures and/or concrete testing for mix design submission.
   2. Qualification of proposed materials and establishment of concrete mixtures.
   3. Other testing services needed or required by the contractor.

F. Materials and installed work may require testing and retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

G. Testing Responsibilities of the Contactor:
   1. Submit data on qualifications of Contractor’s proposed testing agency. Use of testing services will not relive the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
   2. Furnish any labor necessary to assist Owner’s testing agency in obtaining and handling samples at the project site or at the source of materials.
   3. Advise Owners Testing Agency at least 24 hours in advance of operations to allow for completion of quality tests and assignment of personnel.
   4. At the Contractor’s expense, provide and maintain for the sole use of the Owner’s Testing agency adequate facilities for the safe storage and proper curing of concrete test specimens on the project site for initial curing as required by ASTM C31.
   5. SRC mix design testing as outlined in section 1.4.D above.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

I. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

J. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301 "Specification for Structural Concrete."
   2. ACI 117 "Specifications for Tolerances for Concrete Construction and Materials."
   3. ACI 302 "Guide for Concrete Floor and Slab Construction".
   4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
   5. ACI 305 "Hot Weather Concreting".
   6. ACI 306 "Cold Weather Concreting".
   7. ACI 309 "Guide for Consolidation of Concrete".
   8. ACI 347 "Recommended Practice for Concrete Formwork".
   9. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

K. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and re-shoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
   3. Prior to podium slab concrete placement, the Contractor shall conduct the cold-formed steel wall panel pre-installation conference to coordinate the anticipated tolerances between the two systems, see Specification Section 05 4000.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. All Locations: Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces, and adhesion of membranes to concrete.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Deformed-Steel Wire: ASTM A 496.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire,

plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or II, gray or white. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or F.
         1) Limit use of fly ash to not exceed 25 percent of cementitious content by weight.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
         1) Limit use of Ground Granulated Blast-Furnace Slag to not exceed 50 percent of cementitious content by weight.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
   3. For exterior exposed surfaces, do not use fine or course aggregates containing spalling-causing or deleterious substances.

D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.

E. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Shrinkage Reducing Admixture: Grace Concrete Products ECLIPSE FLOOR 200; ASTM C157.

B. Air-Entraining Admixture: ASTM C 260.
   1. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of 5 percent with a tolerance of plus or minus 1 percent.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. “Sika Aer”; Sika Corp.
      b. “MB-VR” or “MB-AE”; Master Builders
      c. “Dorex AEA”; W.R. Grace
      d. “Edoco 2001 or 2002”; Edoco Technical Products

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Use of admixture must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

D. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C. Set-Accelerating Corrosion-Inhibiting Admixtures must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal.
   1. Available Products:
      a. Boral Material Technologies, Inc.; Boral BCN.
      b. Euclid Chemical Company (The); Eucon CIA.
      c. Grace Construction Products, W. R. Grace & Co.; DCI.
      d. Master Builders, Inc.; Rheocrete CNI.
      e. Sika Corporation; Sika CNI.

E. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete. Non-Set-Accelerating Corrosion-Inhibiting Admixture:must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal
   1. Available Products:
      a. Axim Concrete Technologies; Catexol 1000CI.
      b. Boral Material Technologies, Inc.; Boral BCN2.
      c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
      d. Master Builders, Inc.; Rheocrete 222+.
      e. Sika Corporation; FerroGard-901.

2.7 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Available Manufacturers:
      a. Bometals, Inc.
      b. Greenstreak.
      c. Meadows, W. R., Inc.
      d. Tamms Industries, Inc.
      e. Vinylex Corp.
   2. Profile: As indicated.
   3. Dimensions: As indicated; nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
   1. Available Products:
      a. Greenstreak; Swellstop.
      b. Henry Company, Sealants Division; Hydro-Flex.
      c. TCMiraDRI; Mirastop.

2.8 VAPOR RETARDERS

A. Under slab Vapor Barrier: 15 mil minimum thickness, Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced, high density polyethylene, or polyolefin equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.

1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
2. Basis of Design Product:
   a. STEGO INDUSTRIES LLC Product Stego Wrap (15-mil) Vapor Barrier; www.stegoindustries.com
3. Other Acceptable products
   a. Fortifiber Building Systems Group Product Moistop Ultra® 15; www.fortifiber.com.
   b. Reef Industries Product Griffolyn 15 Mil ; www.reefindustries.com.
   c. W.R. Meadows Inc. Product PERMINATOR 15; www.wrmeadows.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.9 FLOOR AND SLAB TREATMENTS

A. General: The contractor shall coordinate and insure that all floor and slab treatments, curing materials and compounds, finish floor materials, related materials, paints, and repair compounds are compatible.

2.10 CURING MATERIALS

A. General: The contractor shall coordinate and insure that all floor and slab treatments, curing materials and compounds, finish floor materials, related materials, paints, and repair compounds are compatible. Evaporation retarder shall not be used where epoxy floor covering is to be placed; slab shall be wet cured with Absorptive Cover or Moisture-Retaining Cover as indicated below.

1. The contractor shall verify and be responsible for insuring the VOC emission limits of authorities having jurisdiction are not exceeded during the project.

B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Available Products:
      a. Burke by Edoco; BurkeFilm.
      b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
      c. Dayton Superior Corporation; Sure Film.
      d. Euclid Chemical Company (The); Eucobar.
      e. L&M Construction Chemicals, Inc.; E-Con.
      f. Meadows, W. R., Inc.; Sealtight Evapre.
      g. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
      h. Sika Corporation, Inc.; SikaFilm.

C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

D. Wet Curing Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet or natural fiber matting attached to plastic sheet backing.
   1. Available products:
      a. PNA Construction Technologies, Inc.; HydraCure S16 Single-Use 7-Day Wet Curing Cover.
      b. Sika Corporation, Inc.; Sika UltraCure NCF Single-Use 7-Day Wet Curing Blanket.

E. Water: Potable.

F. Curing compounds are not permitted for the Podium slab (1st framed floor), moisture curing is required. Curing compounds are permitted for the remaining slabs provided the contractor fully removes the compounds before applying any other treatment to the slab or completing his work at the site and the curing compound does not adversely react with subsequent slab treatments.
   1. Further, the contractor shall verify the application (and subsequent removal) of any curing compound is compatible with any final treatment or finish required by the Architect.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Review curing compounds with manufacturer and waterproofing manufacturer to make sure curing compound does not inhibit adhesion.
   1. Available Products:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. Burke by Edoco; Aqua Resin Cure.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
      f. Euclid Chemical Company (The); Kurez DR VOX.
      g. Kaufman Products, Inc.; Thinfilm 420.
      h. Lambert Corporation; Aqua Kure-Clear.
      i. L&M Construction Chemicals, Inc.; L&M Cure R.
      j. Meadows, W. R., Inc.; 1100 Clear.
      k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
      l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
      m. Tamms Industries, Inc.; Horncure WB 30.
      n. Unitex; Hydro Cure 309.
      o. US Mix Products Company; US Spec Maxcure Resin Clear.
      p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

H. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
   1. Available Products:
      a. Anti-Hydro International, Inc.; AH Clear Cure WB.
      b. Burke by Edoco; Spartan Cote WB II.
      c. ChemMasters; Safe-Cure & Seal 20.
      d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
      e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
      f. Euclid Chemical Company (The); Aqua Cure VOX.
      g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
      h. Lambert Corporation; Glazecote Sealer-20.
      i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
      j. Meadows, W. R., Inc.; Vocomp-20.
      k. Metalcrete Industries; Metcure.
      l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
      m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
      n. Tamms Industries, Inc.; Clearseal WB 150.
      o. Unitex; Hydro Seal.
      p. US Mix Products Company; US Spec Hydrasheen 15 percent
      q. Vexcon Chemicals, Inc.; Starseal 309.

I. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:
    a. Burke by Edoco; Spartan Cote WB II 20 Percent.
    b. ChemMasters; Safe-Cure Clear.
    c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
    d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
    e. Euclid Chemical Company (The); Diamond Clear VOX.
    f. Kaufman Products, Inc.; SureCure Emulsion.
    g. Lambert Corporation; Glazecote Sealer-20.
    h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
    i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
    j. Meadows, W. R., Inc.; Vocomp-20.
    k. Metalcrete Industries; Metcure 0800.
    l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
    m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
    n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
    o. Tamms Industries, Inc.; Clearseal WB STD.
    p. Unitex; Hydro Seal 18.
    q. US Mix Products Company; US Spec Radiance UV-25
    r. Vexcon Chemicals, Inc.; Starseal 0800.

J. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Available Products:
    a. Burke by Edoco; Cureseal 1315.
    b. ChemMasters; Spray-Cure & Seal Plus.
    c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
    d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
    e. Euclid Chemical Company (The); Super Diamond Clear.
    f. Kaufman Products, Inc.; Sure Cure 25.
    g. Lambert Corporation; UV Super Seal.
    h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
    i. Meadows, W. R., Inc.; CS-309/30.
    j. Metalcrete Industries; Seal N Kure 0.
    k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
    l. Tamms Industries, Inc.; LusterSeal 300.
    m. Unitex; Solvent Seal 1315.
    n. US Mix Products Company; US Spec CS-25
    o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315

K. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Available Products:
    a. Burke by Edoco; Cureseal 1315 WB.
    b. ChemMasters; Polyseal WB.
    c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
    d. Euclid Chemical Company (The); Super Diamond Clear VOX.
    e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
    f. Lambert Corporation; UV Safe Seal.
    g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
    h. Meadows, W. R., Inc.; Vocomp-30.
    i. Metalcrete Industries; Metcure 30.
    j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
    k. Tamms Industries, Inc.; LusterSeal WB 300.
    l. Unitex; Hydro Seal 25.

m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Provide plastic expansion joint cap similar to "Snap-Cap", as manufactured by W.R. Meadows, where concrete walks or paving abuts the exterior wall of the buildings.
1. Install expansion joint cap over top of expansion joint and pull out once concrete is cured prior to applying sealant.

C. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 typically unless noted or aromatic polyurea at traffic areas with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

F. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

H. Slab Stud – Shear Reinforcement
1. Provide Decon Studrails or approved equal
2. See Structural Drawings for required configuration and location

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, 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.

B. Concrete type, slump, air content, and maximum water to cementitious content shall be as shown on the Structural Drawings.

C. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Ground Granulated Blast-Furnace Slag: 50 percent.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.
   6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

E. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use of admixture must be approved by the Structural Engineer of Record. Include admixtures as part of mix design submittal
   2. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   4. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   5. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

F. Slump Limits: Proportion and design mixes to result in slump at point of placement as shown on the drawings.
   1. When use of a Type I or II plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C494 is permitted, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Building Members: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: As indicated in drawings.
   2. Maximum Water-Cementitious Materials Ratio: As indicated in drawings.
   3. Slump Limit: As indicated in drawings. 8 inches (200 mm), plus or minus 1 inch (25 mm), for concrete with verified slump indicated in drawings before adding high-range water-reducing admixture or plasticizing admixture].

4. Air Content: As indicated in drawings, at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 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. Mixing and delivery time shall not exceed 90 minutes.
   2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class C, 1/2 inch (13 mm) for all formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.
   4. The contractor shall coordinate with the MEP contractors as required to ensure that the zone of “blue banger hangers” noted on the structural drawings and all other MEP hangers, inserts, sleeves, etc. as needed are in place prior to placing concrete.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

D. Formwork sheets that are no longer providing an acceptable finish in the opinion of the Architect shall be discarded and replaced with new formwork at no additional cost to the project. It is therefore in the best interest of the contractor to care for, clean, oil, and apply liberal amounts of release agent to the formwork as needed to keep it in excellent condition.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Plastic Vapor Retarders: Convene preconstruction meeting prior to starting work. Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" and Structural Drawings for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls no further than 90’ on center. Locate joints midway between piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Slab reinforcement shall not cross contraction joints.
    a. All saw joint in the slab on grade must be made within 3 hours of finishing using appropriate early age cutting equipment (such as soff-cut).

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with the recommendations and intent of ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301. Deliver concrete to meet the following minimum temperatures immediately after placement:
      a. 55 deg F for sections less than 12in. in the least dimension.
      b. 50 deg F for sections 12in. to 36in. in the least dimension.
      c. 45 deg F for sections 36in. to 72in. in the least dimension.
      d. 40 deg F for sections greater than 72in. in the least dimension.
      e. The temperature of concrete as placed shall not exceed these values by more than 20 deg F.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with the recommendations and intent of ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
   1. Apply scratch finish to surfaces indicated by Architect and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated by Architect to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated by Architect, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated by Architect, where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate or aluminum granules over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
   2. After broadcasting and tamping, apply float finish.
   3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations and intent of ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Curing compounds are not permitted for the Podium slab (1st framed floor), moisture curing is required per section 2 or 3 below. Curing compounds are permitted for the remaining slabs provided the contractor fully removes the compounds before applying any other treatment to the slab or completing his work at the site.
      a. Further, the contractor shall verify the application (and subsequent removal) of any curing compound is compatible with any final treatment or finish required by the Architect
   2. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. During concrete finishing:
         1) High-pressure sprayers with fogger nozzles to keep the slab continuously wet throughout finishing operations.
      b. Moisture Curing: Keep surfaces continuously moist for not less than seven days with one of the following methods:
         1) Soaker hoses covered with burlene-type covering (burlap with a white polyethylene covering). Soaker hoses to be left running continuously for the full 7 days to ensure the slab is continuously wet.
   3. Wet Curing Cover: Single-use 7-day wet curing cover to provide 100 percent humidity conditions below the cover. Contractor to follow all manufacturer’s recommendations for installation and monitor slab moisture to ensure 100 percent humidity conditions are maintained for 7 days.
   4. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

b. Further, the contractor shall verify the application (and subsequent removal) of any curing compound is compatible with any final treatment or finish required by the Architect.

5. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions to concrete floors indicated in Architectural Drawings to be troweled and sealed.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than seven days' old unless otherwise required by manufacturer.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports per Specification Section 01 4100.

B. Inspections:
1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 100 cu. yd. (38 cu. m) or fraction thereof.
    a. 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. Slump: ASTM C 143/C 143M; 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.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. 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 (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567 “Standard Test Method for Determining Density of Structural Lightweight Concrete”.
    a. Fresh unit weight of structural lightweight concrete; one test for each composite sample in accordance with ASTM Test Method C 138/C 138M, but not less than one test for each day's pour of each concrete mixture.
    b. Oven-dry unit weight of structural lightweight concrete; one test for each composite sample in accordance with ASTM Test Method C 567, but not less than one test for each day’s pour of each concrete mixture. Make three cylinders for oven-dry density measurements for each composite sample in accordance with ASTM Practice C 31/C 31M.
6. Shrinkage Tests for SRC Concrete: ASTM C157
    a. Test three C157 test specimens for each day the SRC is used.
7. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
    b. Cast and field cure one set of five standard cylinder specimens for each composite sample, where indicated or requested by the Owner.
8. Compressive-Strength Tests: ASTM C 39/C 39M.
    a. Test one laboratory-cured specimen at 7 days and one set of three specimens at 28 days, and retain one specimen for a hold cylinder.
    b. Test one field-cured specimen at 7 days and one set of three specimens at 28 days, and retain one specimen for a hold cylinder, where indicated or requested by the Owner.
    c. Compression test specimens for days not specified shall be at the contractor’s expense.
    d. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, 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 and inspecting 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.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Structural Engineer of Record but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the Contractor's expense when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Structural Engineer of Record. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

CONCRETE SUBMITTAL CHECKLIST

This submittal checklist must be provided with all concrete and reinforcing steel packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal un-checked or as revise and resubmit.

MIX DESIGN		
Included?	Description	Location in project documentation where this requirement is located.
☐	Field data or trial mixture strength data for other than the SRC Mix.	Spec Section 03 3000, Part I, Subsection 1.4, Item C.
☐	Trial mixture date for the SRC Mix ASTM C878 shrinkage test results Compressive Strength Results	Spec Section 03 3000, Part I, Subsection 1.4, Item D.
☐	Verify Mix Design Constraints Limit Fly Ash to 25% Limit Proportions per Spec Section 03 3000, Part II, Subsection 2.5 W/C ratio, Air, Slump per General Notes	Spec Section 03 3000, Part II, Subsection 2.5 General Notes – Section 4.0
☐	Mix Design Data: 1. Proportions of cement, fine and coarse aggregate and water. 2. Water/cement ratio, design strength, slump and air content. 3. Type of cement and aggregates. 4. Type and dosage of all admixtures. 5. Type, color and dosage of integral coloring compounds, where applicable. 6. Special requirements for pumping. 7. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified. 8. Dated test data for the laboratory trial mixture or filed experience method. 9. Material certifications 1) Cementitious materials. 2) Admixtures. 3) Aggregates .	Spec Section 03 3000, Part I, Subsection 1.4 Spec Section 03 3000, Part II, Subsection 2.5, 2.6

REBAR SHOP DRAWINGS		
Included?	Description	Location in project documentation where this requirement is located.
☐	Submit all shop drawings electronically. Electronic copies will be returned to the Architect.	General Notes - Section 2.0 Spec Section 03 3000, Part I, Subsection 1.4
☐	Contract documents not used for shop drawing.	Spec Section 03 3000, Part I, Subsection 1.4
☐	Resubmitted shop drawings have all revised items cloud-ed or identified.	Spec Section 03 3000, Part I, Subsection 1.4
☐	Any requested information, clarifications, requests for	Spec Section 03 3000, Part I, Subsection

	approvals, modifications, etc. as listed in Spec Section 03 3000, Part I, Subsection 1.4 are included by the contractor below.	1.4

FORMWORK, RE-SHORE, OTHER SHOP DRAWINGS		
Included?	Description	Location in project documentation where this requirement is located.
☐	Submit all shop drawings electronically. Electronic copies will be returned to the Architect.	General Notes - Section 2.0 Spec Section 03 3000, Part I, Subsection 1.4
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 03 3000, Part I, Subsection 1.4
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 03 3000, Part I, Subsection 1.4
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 03 3000, Part I, Subsection 1.4 are included by the contractor below.	Spec Section 03 3000, Part I, Subsection 1.4
☐	Formwork shop drawings, shoring and reshoring shop drawings. Calculations stamped by an Engineer registered in the state where the project is located.	Spec Section 03 3000, Part I, Subsection 1.4
QUESTIONS, ETC. PER SECTION 03300, PART I, SUBSECTION 1.4		

END OF SECTION 03 3000

SECTION 03 4500

ARCHITECTURAL PRECAST CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria, materials, production and erection requirements for architectural precast concrete trim and ornamental components of building cladding. for the entire project.

B. The Work performed under this Section shall include all labor, material, equipment, related services and supervision required for the manufacture and erection of the architectural precast concrete shown on the drawings.

C. Supports, anchors, and attachments.

D. Intermediate and perimeter joint seals.

E. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Inspection and Testing.

B. Section 01 7000 - Execution Requirements.

C. Section 03 3000 - Cast-in-Place Concrete: Reinforcing; Admixtures.

D. Section 04 2000 - Unit Masonry.

E. Section 07 9200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

H. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

J. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

L. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

M. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

N. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

O. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.

P. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

R. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

T. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

U. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

W. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

X. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2007.

Y. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; 2010, Seventh Edition.

Z. PCI MNL-122 - Architectural Precast Concrete; 2007, Third Edition.

AA. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988, Second Edition. AB. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 DESIGN REQUIREMENTS

A. Design units to withstand design loads as calculated in accordance with 2009 International Building / ASCE-7 2005 code, and erection forces. Calculate structural properties of units in accordance with ACI 318.

B. Design units to withstand static loads and anticipated dynamic loading, including positive and negative wind loads and thermal movement loads.

C. Design and size components to withstand seismic loads and sway displacement as calculated in accordance with 2009 International Building code.

D. Design units to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

E. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

F. Drawings are diagrammatic, showing basic dimensions of the modules, sight lines, jointing, and profiles. Contractor may propose modifications to panel configurations to facilitate transportation and handling, subject to approval by the Architect.
   1. Panel joints are permitted only at reveals and joint locations shown on the design drawings.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to the installation of precast work a meeting shall be held at the project site to review installation procedures and coordination of the precast installation with affected work of other trades. The meeting shall include the respective Architectural Precast Subcontractor, Contractor, Architect, and representatives of other trades affected by each type of precast work. Subject meeting to be held two weeks prior to commencing erection of any precast units.

B. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed,

reviewed, and approved.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for requirements.

B. Product Data: For each type of product indicated.

C. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

D. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

E. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
   1. Indicate separate face and backup mixture locations and thicknesses.
   2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
   3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
   4. Indicate relationship of architectural precast concrete units to adjacent materials.
   5. Show locations and details of sealant joints, and mortar joints "pointed" with sealant.
   6. Include large-scale shaded elevations and details of decorative surfaces and inscriptions.
   7. Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
      a. Include details of mix designs.
      b. Include structural design calculations.
   8. Design the connections with sufficient adjustment ability to accommodate the allowable tolerances and deflection of the base building structure and casting tolerances.
   9. Provide means of adjustment in the erected precast panels to allow repositioning prior to Provide means of adjustment in the erected precast panels to allow repositioning prior to final welding or bolting in place. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.
   10. Include plans and elevations showing unit location and sequence of erection for special conditions.
   11. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

F. Supplemental Framing: Where loading from precast panels transmits forces to the building structural frame, which exceed the capacity of the frame, additional bracing if required shall be submitted for approval.
   1. Provide all supplemental steel supports and bracing required to stiffen the frame for adequate support.
   2. The final design and selection of connection systems shall be the sole responsibility of the Contractor.
   3. Provide a minimum of two gravity connections for precast panels.

G. Samples for initial verification: Submit three plant cast, 12 x 12 x 4 inch in size, illustrating surface finish, color and texture for each type of finish indicated on exposed surfaces of architectural precast concrete units. Submit in sets of 3, illustrating full range of finish, color, and texture variations expected.
   1. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate

adequacy of repair techniques proposed for repair of surface blemishes.

2. Apply approved water repellent as required to samples of architectural precast to demonstrate effects to final color and finish.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Material Test Reports: For aggregates.

D. Material Certificates: For the following items, signed by manufacturers:
   1. Cementitious materials.
   2. Reinforcing materials.
   3. Admixtures.
   4. Bearing pads.

E. Field quality-control test and special inspection reports.

1.08 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Alabama.

B. Design Standard: Perform the work of this section in accordance with ACI-318 and PCI MNL-120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
   1. Maintain one copy of each document on site.

C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

D. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."

E. Fabricator Qualifications:
   1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
   2. Participates in PCI's plant certification program at time of bidding and is designated a PCI-certified plant for Group A, Category A1 - or participates in APA's "Plant Certification Program for Production of Architectural Precast Concrete Products" and is designated an APA-certified plant.
   3. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete: Architectural Cladding and Load Bearing Units.
   4. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.

F. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Alabama.

G. Erector Qualifications: The precast concrete erector shall be fully qualified by the Precast/Prestressed Concrete Institute prior to beginning any work at the jobsite. He shall be qualified for Group A1-Architectural Concrete.

H. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1/D1.1M and AWS D1.4/D1.4M.

I. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

J. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

K. Quality-Control Standard: For manufacturing procedures and testing requirements, quality control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

L. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."

M. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

N. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample panels approximately 16 sq. ft. (1.5 sq. m) in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
   1. Locate panels where indicated or, if not indicated, as directed by Architect.
   2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
   3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.

O. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of 3 sets of samples, approximately 16 sq. ft. (1.5 sq. m) in area, representing anticipated range of each color and texture on Project's units. Following range sample, maintain one set of samples at Project site and remaining sample sets at manufacturer's plant as color and texture approval reference.

1.09 MOCK-UP

A. After sample panel and range sample approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals, to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup as indicated on the Drawings of architectural precast concrete complete with anchors, connections, flashings, and joint fillers.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

B. Locate where directed.

C. Mock-up may remain on site only as the standard of workmanship and quality for the Work of this installation, but not part of the finished construction.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.

F. Lift and support precast units only from support points verified in field from designated points shown on Shop Drawings.

G. Place stored units so identification marks are clearly visible, and units can be inspected.

H. Protect units to prevent staining, chipping, or spalling of concrete.

I. Mark units with date of production in location that will be concealed after installation.

1.11 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:
   1. Any manufacturer holding a PCI Group A Plant Certification, or APA Plant Certification for the types of products specified; see www.pci.org.
   2. Available Fabricators for Architectural Precast Units: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Castone Corporation; Opelika, AL.: www.castonecorp.com
      b. Columbia Precast, LLC; Columbia, TN.www.columbiaprecast.com
      c. Gate Precast Company; Ashland City, TN.: www.gateprecast.com
      d. Miller-Mize Precast, Inc., Columbus GA.: www.millermizeprecast.com
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
   1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.03 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.
      a. Backup Mix: Same aggregate-cement ratio as face mix; achieve 28 day compressive strength of 5000 psi.
   2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   3. Calculate structural properties of units in accordance with ACI 318.
   4. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength and appearance requirements and is not in excess of Industry recommendations.
   5. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   6. Provide connections that accommodate building movement and thermal movement and adjust

to misalignment of structure without unit distortion or damage.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi).
   1. Deformed billet-steel bars.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
   1. Deformed billet steel bars; Galvanized in accordance with ASTM A 767/A 767M, Class I.

C. Steel Welded Wire Reinforcement: Galvanized ASTM A 185/A 185M, plain type.
   1. Flat Sheets.
   2. Mesh Size: 6 x 6.
   3. Wire Gage: 10 x 10.
   4. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.05 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

C. Supplementary Cementitious Materials:
   1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
   2. Metakaolin Admixture: ASTM C 618, Class N.
   3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
   4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
   1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
   2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

G. Air Entrainment Admixture: ASTM C260/C260M.

H. Grout:
   1. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C
      404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
   2. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.
   3. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.06 SUPPORT DEVICES AND CONNECTION MATERIALS

A. Steel Items

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
2. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
3. Carbon-Steel Plate: ASTM A 283/A 283M.
4. Malleable Iron Castings: ASTM A 47/A 47M.
5. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
6. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
7. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
8. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
9. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
10. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
11. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
12. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
    a. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
    b. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
13. Welding Electrodes: Comply with AWS standards.
14. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
    a. Clean surfaces of rust, scale, grease, and foreign matter.
    b. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.
15. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (ASTM A563M) nuts and matching washers.
16. Primer: Zinc rich type.

2.07 BEARING PADS

A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
    1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
    2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
    3. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.08 ACCESSORIES

A. Reglets: Specified in Section 07 6200 - Sheet Metal Flashing and Trim.

B. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

C. Sealant: silicone type specified in Section 07 9200.

2.09 MIX

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures shall be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 WATER REPELLANTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
   1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
      a. Architectural precast concrete: ASTM C 97.
   2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
   3. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.
   4. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.

B. Product: Protectosil Aqua-Trete SG by Degussa Corporation, Theodore, Alabama.

2.11 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
   1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
   1. Form joints are not permitted on faces exposed to view in the finished work.

2. Edge and Corner Treatment: As detailed.

2.12 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
   1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

C. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

D. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

E. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings without Architect's approval.

F. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
   1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
   2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
   3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
   4. Place reinforcing steel to maintain at least 1-inch (25-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
   5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing 6 inches (150 mm) and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

G. Reinforce architectural precast concrete units to compensate for handling, transportation, and erection stresses.

H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

K. Comply with PCI MNL 117 for hot-and cold-weather concrete placement.

L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

O. Maintain plant records and quality control program during production of precast units. Make records available upon request.

P. Maintain consistent quality during manufacture.

Q. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

R. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

S. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.13 FINISH - PRECAST UNITS

A. Finish Type light sandblast, stone texture: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

2.14 FINISH - SUPPORT DEVICES

A. Exposed finish surfaces shall match accepted samples and mock-up panels in all respects. All panels shall be provided with square edged, smooth joints prior to applying surface treatments to produce a precast finish consistent with accepted samples. Maintain consistent time interval (casting through finishing) for precast work. Protect false joints to preserve uniform straight, sharp corners.

B. Clean surfaces of rust, scale, grease, and foreign matter.

C. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

D. Galvanize after fabrication in accordance with requirements of ASTM A 123/A 123M.

2.15 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below.

B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
    a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
    b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
    c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
    d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
    a. 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
    b. 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).
    c. 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
    d. Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).
3. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).

4. Rib Thickness: Plus or minus 1/8 inch (3 mm).
5. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
6. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
10. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
11. Local Smoothness: 1/4 inch per 10 feet (6 mm per 3 m), non cumulative.
12. Warping: 1/16 inch per 12 inches (1.5 mm per 300 mm) of distance from nearest adjacent corner.
13. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
14. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
15. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
    a. Weld Plates: Plus or minus 1 inch (25 mm).
    b. Inserts: Plus or minus 1/2 inch (13 mm).
    c. Handling Devices: Plus or minus 3 inches (75 mm).
    d. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
    e. Location of Flashing Reglets: Plus or minus 1/4 inch (6 mm).
    f. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
    g. Position of Sleeve: Plus or minus 1/2 inch (13 mm).

2.16 FINISHES

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:
   1. Color and Texture: Provide units with texture and color. See Drawings for two colors/finishes.
   2. Smooth-Surface Finish: Provide surfaces free of pockets, sand streaks, and honeycombs, with uniform color and texture.
   3. Finish exposed top, bottom and back surfaces of architectural precast concrete units to match face-surface finish.
   4. Finish exposed top, bottom and back surfaces of architectural precast concrete units by smooth, steel-trowel finish.
   5. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.17 SOURCE QUALITY CONTROL

A. Provide testing of concrete mix as follows.
   1. Take 4 concrete test cylinders for every 12 cu yd of concrete placed; make and cure in accordance with ASTM C31/C31M.
   2. Take 1 slump tests for each set of test cylinders in accordance with ASTM C 143/C 143M.
   3. Take one air entrainment test cylinders for each set of exterior concrete test cylinders taken.
   4. Take water absorption test in accordance with PCI MNL-117.

B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

C. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
   1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

D. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

E. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
   1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
   2. Cores will be tested in an air-dry condition.
   3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
   4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
      a. Project identification name and number.
      b. Date when tests were performed.
      c. Name of precast concrete fabricator.
      d. Name of concrete testing agency.
      e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

F. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

G. Inspect precast concrete panels at fabricator's plant prior to shipment to observe exposed

H. finishes.
   1. Repair exposed surface cracks that don't comply with fabrication standards and seek approval from the Contractor prior to shipment to the site. Do not ship damaged panels to the site for subsequent repairs.
   2. Precast units that do not meet the color and texture range may be rejected at the option of the Architect if they cannot be satisfactorily corrected.
   3. Repairs will not be permitted for units with structural defects. Acceptance of repaired units is contingent upon the following:
      a. Repairs done skillfully so as to be sound, permanent, and flush with adjacent surfaces.
      b. Color and texture of repaired areas match adjoining surfaces without showing any line of demarcation between repair and original concrete when viewed in adequate, normal daylight conditions with unaided naked eye at 20 foot viewing distance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section. Commencement of installation of connectors and other attachment accessories indicates acceptance of conditions.

3.02 PREPARATION

A. Correct any unsatisfactory conditions which may hinder or prevent effective installation of attachment and connection accessories and precast units.

B. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
   1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
   2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
   3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
   4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).

B. Erect units without damage to shape or finish. Repair or replace damaged panels.

C. Erect units level and plumb within allowable tolerances.

D. Align and maintain uniform horizontal and vertical joints as erection progresses.

E. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.

F. Fasten units in place with mechanical connections and as follows.
   1. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
      a. Do not permit connections to disrupt continuity of roof flashing.
      b. Do not permit connections to compromise weatherproof integrity of building envelope.

G. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
   1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
   2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
   3. Clean weld-affected metal surfaces with chipping hammer followed by brushing and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
   4. Remove, reweld, or repair incomplete and defective welds.

H. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
   1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

I. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

J. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

K. Seal perimeter and intermediate joints with neutral cure silicone sealant in accordance with Section 07 9200.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except

as specifically amended below.

B. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I and as amended below.
   1. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:
      a. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
      b. Plan Location from Centerline of Steel: Plus or minus 1/2 inch (13 mm).
      c. Top Elevation from Nominal Top Elevation: As follows:
         1) Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
         2) Non-Exposed Individual Panel: Plus or minus 1/2 inch (13 mm).
         3) Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
         4) Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch (13 mm).
      d. Support Elevation from Nominal Support Elevation: As follows:
         1) Maximum Low: 1/2 inch (13 mm).
         2) Maximum High: 1/4 inch (6 mm).
      e. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
      f. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
      g. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
      h. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch (6 mm).
      i. Maximum Joint Taper: 3/8 inch (10 mm).
      j. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).
      k. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).
      l. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).
      m. Opening Height between Spandrels: Plus or minus 1/4 inch (6 mm).

3.05 FIELD QUALITY CONTROL

A. SPECIAL INSPECTIONS Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
   1. Erection of precast concrete members.
   2. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
   3. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
   4. Testing agency will report test results promptly and in writing to Contractor and Architect.
   5. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   6. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.07 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

3.08 APPLICATION OF WATER REPELLENTS

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

C. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

3.09 SCHEDULES See Drawings

END OF SECTION

SECTION 03 5400

SELF LEVELING CEMENT BASED UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied, self-leveling, portland cement based floor underlayment.
   1. Cementitious type at To be installed at an average of 1 inch in thickness at all existing interior concrete substrates which are scheduled to receive a finish floor material , or coating.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements.

B. Section 01 2100 - Allowances

C. Section 03 3000 - Cast-in-Place Concrete.

D. Division 9 - Finishes.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on mixing instructions.

C. Show method for protecting gypsum board and other materials subject to damage/degradation from contact with underlayment installation.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Instructions.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.07 MOCK-UP

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Prepare mock-up in location designated by Architect.
   2. Area: min. 10 ft x 10 ft.
   3. Do not proceed with underlayment work until workmanship of mock-up has been approved by Architect.

B. Mock-up may remain as part of the Work.

1.08 PRE-INSTALLATION MEETING

A. Convene a minimum of one week before starting work of this section, but not before construction and approval of mock-up and all related submittals.

1.09 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cementitious Underlayment:
   1. ARDEX Engineered Cements; ARDEX K 15® Premium Self Leveling Underlayment: www.ardexamericas.com.
   2. Custom® Building Products; LevelLite® Self-Leveling Underlayment: www.custombuildingproducts.com.
   3. ProSpec, an Oldcastle brand; Level Set 200: www.prospec.com.
   4. USG; USG Durock® Brand UltraCap® Self-Leveling Underlayment is ideal : www.usg.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Cast Underlayments, General:
   1. Comply with applicable code for combustibility or flame spread requirements.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   1. Compressive Strength: Minimum 5,500 pounds per square inch after 28 days, tested per ASTM C109/C109M.
   2. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
   3. Density: 125 pounds per cubic foot, nominal.
   4. Final Set Time: 1-1/2 to 2 hours, maximum.
   5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex-based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. **See Note in part 3 regarding the disposal of excess material and cleaning of equipment.**

C. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

D. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime substrate in accordance with manufacturer's instructions. Allow to dry. Protect adjacent gypsum board and other materials subject to damage/degradation from contact with primer installation.

E. Close floor openings.

F. Protect gypsum board and other materials subject to damage/degradation from contact with underlayment installation.

3.03 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Do not create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

D. Place to thickness as indicated, including sloping as noted on Drawings.

E. For final thickness over 1-1/2 inches, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours, or the minimum allowed by manufacturer.
   1. Provide Manufacturer's recommended reinforcement material, or additional aggregate

F. Place after partition installation, protect gypsum board during installation.

G. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

H. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.05 APPLICATION TOLERANCE

A. Top Surface: Level to 1/8 inch in 10 ft.

3.06 FIELD QUALITY CONTROL

A. An independent testing agency will perform field inspection and testing, as specified in Section 01 4000 - Quality Requirements.

B. Placed Material: Agency will inspect and test for compliance with specification requirements.

C. **NOTE : Excess material shall not be disposed of into sinks, tubs, or in any manner which could cause it to enter a sanitary drain system. Likewise, cleaning of tools, buckets, equipment or any implements**

used for installation of the material shall not occur using any water source adjacent to, or which empties into any part of a sanitary drainage system.

3.07 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

SCHEDULE (See Drawings)

END OF SECTION 03 5400

SECTION 04 2000

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Common brick.

D. Mortar and grout.

E. Reinforcement and anchorage.

F. Flashings.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 03 4500 - Precast Architectural Concrete

C. Section 04720 - Cast Stone

D. Section 04 0100 - Masonry Cleaning and Restoration.

E. Section 05 5000 - Metal Fabrications: Loose steel lintels and Fabricated steel items.

F. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.

G. Section 07 2600 - Air Barriers: Water resistant membrane applied at masonry surfaces, where indicated.

H. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

I. Section 07 2119 - Foamed in Place Insulation : Foamed in place insulation for voids at material transitions from / to masonry, around openings etc..

J. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

K. Section 07 9200 - Joint Sealants: Sealing material transitions, control and expansion joints.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

B. This allowance includes purchase and delivery of clay facing brick. Installation is not included in the allowance but is specified in this section and is part of the Contract Sum/Price.

1.04 REFERENCE STANDARDS

A. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

I. ASTM C55 - Standard Specification for Concrete Building Brick; 2017.

J. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2017.

K. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2021.

L. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

M. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.

N. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

O. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2020a.

P. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

R. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

S. ASTM C212 - Standard Specification for Structural Clay Facing Tile; 2021.

T. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2021.

U. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

V. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

W. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

X. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale); 2021.

Y. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

Z. ASTM C1634 - Standard Specification for Concrete Facing Brick; 2017.

AA. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

AB. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2001.

AC. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.

AD. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a, with Editorial Revision (2013).

AE. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

AF. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls;2005.

AG. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

AH. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

AI. BIA - Brick Institute of America - Technical Notes on Brick Construction.

AJ. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

AK. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

AL. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene the preinstallation meeting one week before starting work of this section; require attendance by all relevant installers of work affected by masonry or which affects the installation of the masonry. Dependent upon sequencing of the Work the following may require attendance including:
   1 General Contractor
   2 Masonry subcontractor.
   3 Pre-cast architectural concrete subcontractor.
   4 Glass / Glazing subcontractor.
   5 Waterproofing / Caulking and Sealant subcontractor

B. Do not schedule a preinstallation meeting before all submittals, samples and mock-up have been completed and approved.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings:
   1 For reinforcing steel and layout of masonry units. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
      a. Show elevations of masonry walls indicating the reinforcing locations and sizes.

D. Samples: Submit four samples of each type facing brick units to illustrate color, texture, and extremes of color range.
   1 Face brick samples must be provided from the same kiln firing and clay source as the brick that will be used for this project.

1.07 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

B. Material Certificates: For each type and size of the following:
   1 Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For exposed brick, include test report for efflorescence according to ASTM C 67.
         1) Test reports for face brick must be specific to the specified product. The testing must accurately represent the brick that will be used in the project.
      c. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2 Cementitious materials. Include brand, type, and name of manufacturer.
   3 Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4 Grout mixes. Include description of type and proportions of ingredients.

1.08 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1 Maintain one copy of each document on project site.

B. Comply with Section 01 4110 - Special Inspections.

C. Installer Qualifications: Company specializing in performing work of the type specified and employing skilled Trades people with at least 15 years of documented experience.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
   1 Note: Masonry Cement is not permitted for use on this project.

F. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents

G. Special Inspections for this project shall be as required by the Statement of Special Inspections for Masonry Construction. See Section 01 4000 Quality Requirements, Section 01 4110 - QA QC Special Tests and Structural Inspections and the Schedule of Special Inspections on the Structural Drawings and in the structural specifications .

1.09 SAMPLE PANELS FOR INITIAL: SELECTION

A. Construct up to 6 brick sample panels for the brick type, color range, mortar color, and joint tooling sample panel(s) to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 4000 - Quality Requirements for mockups and as follows.
   1 Size: should be adequate to provide the requirements outlined above but no smaller than 52 inches long x 48 inches in height

1.10 SAMPLE PANELS FOR FINAL SELECTION

A. Final Selection Sample Panel: After initial selections and Prior to erection of comprehensive envelope mockup, construct additional sample veneer panels as required to verify selections made under initial sample submittals and to confirm aesthetic effects as well as other qualities of materials and execution. Build panels to comply with the following requirements, using materials indicated for final unit of Work.
   1 Locate mockups on site in the locations indicated or, as directed by Architect.
   2 Depending upon range of brick colors, mortar color selections in combination with brick, build one (1) mockup for review with exterior face brick in sizes approximately 76 inches (6'-4") inches long by 72 inches (6'-0") in height by full thickness, and as follows:
      a. The Architect will select from the sample mockups as the basis for the freestanding building envelope mockup shown on the Drawings and described below.

1.11 MOCK-UP

A. Build independent, freestanding mockup of typical exterior face brick construction as detailed on the drawings. Mockup wall shall be a composite representation of the actual design for the purpose of evaluating the quality, workmanship, and intersection of the various facing materials. Construct the mockup as detailed on the drawings and as follows:
   1 Typical wall construction shall include final approved face brick, mortar, masonry backup, through-wall flashing, including end dams, metal drip edges, and termination bars, masonry ties, steel lintel, weeps, bond breaker strips, vertical expansion joint, and joint sealant.
   2 Include typical window at least as shown.
   3 Demonstrate grouting of CMU backup in accordance with the specifications.
   4 Test weep system in the cavity wall to insure that it functions as intended. Make adjustments to weep system as necessary and implement into the permanent walls.
   5 Provide leave out areas of brick

B. Protect accepted mockups from the elements with weather-resistant membrane.

C. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

D. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   1 Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   2 Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

E. Approved mock-up shall remain on site as the standard of acceptable quality for construction of masonry and related work.

1.12 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section, but not before construction and approval of masonry mock-up panel and required submittal information.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store all masonry units on pallets, off the ground and protected with waterproof cover.

C. Do not permit metal banding to contact brick.

1.14 ENVIRONMENTAL REQUIREMENTS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

1.15 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1 Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2 Special Shapes: Provide non-standard blocks configured for corners, headers, and other detailed conditions and as follows.
      a. Provide bullnose units for outside corners, and jamb blocks of openings in exposed areas and as detailed.
      b. Provide straight, square edge units at first course above concrete slab where resilient, or other wall base material is scheduled and top course below suspended acoustical and hard ceilings, unless noted otherwise.
   3 Load-Bearing Units: ASTM C90, normal weight.
   4 Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Normal weight.

2.02 BRICK UNITS

A. Manufacturers:
   1 ACME Brick; www. brick.com
   2 Alabama Brick; www.alabamabrick.com
   3 See Section 01 2500 for Substitution Procedures.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1 Color and texture: Match brick on existing buildings
   2 Actual size: To match the original brick exactly and as follows:

3 Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

C. Building (Common) Brick: ASTM C62, Grade SW; solid units.
1 Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar Cement: Type N for typical above grade applications, Type S for load bearing and below grade applications
1 All masonry mortar cement shall be obtained from one of the listed manufacturers
2 Acceptable Manufacturers:
a. Cemex
b. Citadel
c. Holcim
d. La Farge
e. Substitutions: See Section 01 6000 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
1 Not more than 0.60 percent alkali.
2 Hydrated Lime: ASTM C207, Type S.
3 Mortar Aggregate: ASTM C144.
4 Grout Aggregate: ASTM C404.

C. Water: Clean and potable.

D. Packaged Dry Material for Mortar for Unit Masonry is preferred: Premixed Portland cement, hydrated lime, and sand; complying with 1 and capable of producing mortar of the specified strength in accordance with 2 with the addition of water only.
1 Type: Type N.
2 Color: Standard gray or white as required to produce correct color.

2.04 REINFORCEMENT AND ANCHORAGE

A. Wall Ties and Anchors: Brick Veneer / Frame and Sheathing backup.
1 Basis of Design Hohmann & Barnard, Inc; X-Seal Transition Anchor Tape / X-Seal® Veneer Anchor: www.h-b.com/sle.
2 Hohmann & Barnard, Inc; Product DW-10HS www.h-b.com.
a. Provide #360 Gripstay Channel with #363 - Flexible Gripstay Anchor for attachment to steel structure.
3 Masonry Reinforcing Corporation of America; Product Type III with anchor seal, www.wirebond.com.
a. Provide #2800, or #2801 for attachment to steel structure.
4 Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcement and Anchors: CMU / Brick veneer.
1 Dur-O-Wal: Product - A3700 Dur-O-Eye www.dur-o-wal.com.;
2 Hohmann & Barnard, Inc; Product #165 www.h-b.com.
3 Masonry Reinforcing Corporation of America; Series 700, www.wirebond.com.
4 Substitutions: See Section 01600 - Product Requirements.

C. Reinforcement: Single wythe CMU.
1 Dur-O-Wal: Product -DA3100 Truss or DA3200 Ladur :www.dur-o-wal.com.
2 Hohmann & Barnard, Inc; Product #165 www.h-b.com.
3 Hohmann & Barnard, Inc; Product #220 www.h-b.com.
4 Masonry Reinforcing Corporation of America; Truss Type Series 300, or Ladder Type Series 200; www.wirebond.com

D. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

E. Single Wythe Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

F. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M, Class B.

G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
   1 Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
   2 Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

2.05 FLASHINGS (CONCEALED)

A. Provide .040 Elvoloy Kee, non-asphalt, self-adhesive membrane or copper fabric Non Adhesive, non-asphalt fabric 502 coated copper where applicable.
   1 **Rubberized asphalt sheet products are not permitted for any through wall flashing applications.**

B. Approved Flashing materials and Products:
   1 Advanced Building Products, Inc.; Copper Fabric Flashing
   2 AFCO Products, Inc.; Copper Fabric
   3 Hohmann & Barnard, Inc.; H & B C-Fab Flashing
   4 Phoenix Building Products; Type FCC-Fabric Covered Copper

C. Other Acceptable Materials and Products
   1 Copper/Polymer Film or Fabric Flashing: 3 oz/sq ft copper sheet laminated between two sheets of polyethylene film. Minimum Puncture Resistance of 780 psi, when measured in accordance with ASTM E154/E154M.
      a. Manufacturers:
         1) York Manufacturing, Inc; Multi-Flash 500 Series: www.yorkmfg.com/#sle.
         2) Substitutions: See Section 01 6000 - Product Requirements.
   2 Copper/Polymer Fabric Drainage Plane Flashing System: 3 oz/sq ft copper sheet bonded with rubber-based adhesive between one sheet of polymer fabric and one sheet of non-woven drainage material.
      a. Manufacturers:
         1) York Manufacturing, Inc; Flash-Vent: www.yorkmfg.com/#sle.
         2) Substitutions: See Section 01 6000 - Product Requirements.

D. Flexible Flashing with Elvaloy KEE: Solid-phase plasticizer and flexibilizer added to membrane flashing.
   1 Manufacturers: Basis of Design
      a. Hohmann & Barnard, Inc; Flex-Flash® Flashing: www.h-b.com/sle.

E. Stainless Steel Through wall drip edge: 1, Type 304, soft temper; 24 gage, 0.020 inch thick; finish 2B to 2D.

F. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1 Manufacturers: Basis of Design : Wall Joints Above-Grade:
      a. EMSEAL JOINT SYSTEMS LTD Product Seismic Colorseal; Seismic Colorseal - DS.

2 Manufacturers: Basis of Design : Wall Joints Below-Grade :
a. EMSEAL JOINT SYSTEMS LTD Product DMS System; DMS - DS System
3 Other Acceptable Manufacturers
a. Dur-O-Wal: www.dur-o-wal.com.
b. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
c. Masonry Reinforcing Corporation of America: www.wirebond.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding; + 1/2 inch of the joint space wide by maximum lengths available.
1 Manufacturers:
a. Hohmann & Barnard, Inc: www.h-b.com/sle.
b. WIRE-BOND; _____: www.wirebond.com/#sle.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1 Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
a. Manufacturers:
1) Advanced Building Products Inc; Mortar Break: www.advancedbuildingproducts.com/#sle.
2) Hohmann & Barnard, Inc.; Product Mortar Net™. www.h-b.com.
3) Substitutions: See Section 01 6000 - Product Requirements.

D. Weeps:
1 Type: Molded PVC grilles, insect resistant, color to match mortar, width and height equal iin dimension to 1 head joint.
2 Manufacturers:
a. Dur-O-Wal; Product DA1006 Cell Vents : www.dur-o-wal.com.
b. Hohmann & Barnard, Inc: www.h-b.com/sle.
c. WIRE-BOND: www.wirebond.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials. See Section 04 0100.

2.07 LINTELS (GALVANIZED STEEL, SEE SECTION 05500 - METAL FABRICATIONS)

2.08 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1 Masonry below grade and in contact with earth: Type S.
2 Exterior, loadbearing masonry: Type S.
3 Exterior, non-loadbearing masonry: Type N.
4 Interior, loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1 Bond: As indicated for different locations unless otherwise noted.
   2 Coursing: One unit and one mortar joint to equal 8 inches.
   3 Mortar Joints: Tooled Concave.

D. Brick Units:
   1 Bond: As indicated for different locations.
   2 Mortar Joints: Concave / Vee shape tooled, or weathered as shown on drawings.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Maintain consistent 3/8 inch minimum 7/16 inch maximum width open perimeter at window and door units for full sealant joint.

3.06 EFFLORESCENCE PREVENTION / CAVITY PROTECTION

A. All masonry unit cubes (pallets)s shall be stored off the ground and protected with waterproof cover having sufficient ventilation to prevent condensation.

B. Mortar shall be proportioned and mixed as specified, mortar shall not be retempered , and shall be

C. Top course of unfinished masonry walls shall be covered properly at the end of each working day to keep rainwater out of the wall. The cover shall extend a minimum of 2’ down the face of the wall. For more information about efflorescence, visit website : www.bia.org

3.07 WEEPS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.08 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches maximum on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1 Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 6 inches, minimum, above cavity mortar control material to form watertight pan at non-masonry construction.
   2 Secure flashing with stainless steel, termination bar with caulk tray.
   3 Provide continuous 4 inch wide galvanized 18 gauge steel strapping fastened to studs as blocking for all termination bar locations.
   4 Remove or cover protrusions or sharp edges that could puncture flashings.
   5 Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings to within a set dimension of the exterior face of masonry as detailed on the drawings, .

C. Extend plastic, laminated, and EPDM flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

D. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

A. Install loose steel lintels over openings.

3.12 GROUTED COMPONENTS

A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

B. Place and consolidate grout fill without displacing reinforcing.

C. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

E. Form expansion joint as detailed on drawings.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1 Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.15 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.16 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

C. Cutting with trowel, or brick hammer is prohibited. Cutting of masonry units to be performed with properly fitted, powered masonry saw.

3.17 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.18 CLEANING

A. Remove excess mortar and mortar droppings as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.

2. Grout.

3. High Performance Coatings for steel exposed to weather

B. Related Sections include the following:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

2. Division 01 Section 2300 “Alternates” for Structural Steel included in alternates.

3. Division 05 Section “Steel Joist Framing”

4. Division 05 Section "Steel Decking" for field installation of shear connectors.

5. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.

6. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC’s “Manual of Steel Construction - 13TH Edition.

2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections. All structural steel connections not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State where

the project is located. Engineer/firm shall provide proof of professional liability insurance for said engineering responsibility.

a. Design calculations for the connections designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State where the project is located. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.

B. Construction: Type PR, partially restrained.

C. Construction: Type 2, simple framing.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. The contractor shall fill out the Structural Steel Submittal Checklist and include it as part of his shop drawing submittal package. Submittals without the checklist will be returned unchecked as an incomplete submittal. The checklist sheet is located at the end of this specification section.

a. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the checklist. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the checklist and subsequently not explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.

2. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All copies required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Shop drawings prepared under supervision of a licensed Structural Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams. Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Contract documents shall not be used for shop drawing, including erection plans or details.

6. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.

7. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

8. For each connection, the following shall be noted on the shop drawings:

    a. Required design reaction

    b. Calculation sheet number for design

    c. Capacity of detailed connection

    d. Stamp of Engineer submitting calculations for the connection

9. All shop drawings which do not provide this information will be returned unchecked as an incomplete submittal.

10. Structural Design Group shall have a minimum of 14 business days from date of receipt in our office before turning the shop drawings over to the Architect for his review or before returning them revise and resubmit.

D. Welding certificates.

E. Qualification Data: For fabricator, professional engineer and testing agency.

F. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

3. Direct-tension indicators.

4. Tension-control, high-strength bolt-nut-washer assemblies.

5. Shear stud connectors.

6. Shop primers.

7. Nonshrink grout.

G. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Cbd.

1. Fabricator’s not AISC-Certified may be used provided testing agency performs a shop special inspection of fabricators plant according to “Fabricator and Inspection Requirements for Steel Fabrication Shops Not AISC Certified” contained in Section 01410. Shop Special Inspection costs shall be borne by the Fabricator.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

2. If recertification of welders is required, retesting will be Contractor's responsibility

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."

    a. General: AISC "Code of Standard Practice" shall apply except to the extent that references are made to the responsibility of the Owner and/or Architect or Engineer in which event those references shall have no applicability. Where a conflict exists between the Code of Standard Practice and the Construction Documents, the Construction Documents shall govern.

2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."

3. AISC's "Specification for Structural Steel Buildings - AISC 360-05."

4. AISC's "Specification for the Design of Steel Hollow Structural Sections."

5. AISC's "Specification for Design of Single-Angle Members"

6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.

1. Coordinate finish painting requirements with Division 09 painting Sections.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Trade contractor furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation. Coordinate with Construction Manager.

B. Trade contractor shall coordinate structural steel with steel joist framing requirements in coordination with Construction Manager..

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M, Grade 50 (345).

B. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade [B] [C], structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard.

2. Finish: Black, except where indicated to be galvanized].

F. Welding Electrodes: Comply with AWS requirements.

G. Connection Material: Unless noted otherwise on the drawings, stiffener plates, doubler plates, gusset plates and the connecting plates shall be the same grade (yield strength) of steel as members being connected.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type.

a. Finish: Plain.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M,) Type 10.9, compressible-washer type, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.

2. Plate Washers: ASTM A 36/A 36M carbon steel.

3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.

4. Finish: Plain.

F. Threaded Rods: ASTM A 193/A 193M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.

2. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.

3. Finish: Plain.

G. Clevises or Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings-AISC 360-05."

1. Camber structural-steel members where indicated.

2. Identify high-strength structural steel according to ASTM A6/ A 6M and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.

4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard (and oversized, short-slotted, or long where noted on the drawings) bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spacing and number as indicated in the project documents, to beams and girders in composite construction. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.Do not thermally cut bolt holes or enlarge holes by burning.

2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

J. Expansion Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical brick expansion joints as indicated on drawings.

K. Embed Plates: Provide single ¼” hole in center of each plate.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Seismic Provisions For Structural Buildings.” Where requirements of said document conflict with these specifications, the more stringent requirement (as determined by the Structural Engineer of Record) shall apply.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.

b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.6 SHOP PRIMING UNLESS NOTED OTHERWISE

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials.

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

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

2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 SHOP PRIMING INTERIOR AREAS THAT WILL BE EXPOSED TO VIEW OR THAT ARE TO RECEIVE AN INTERIOR GRADE PAINT

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials.

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning.”

C. Primer: Immediately after surface preparation, apply to a dry film thickness of 2.5 to 3 mils a primer, such as Sherwin Williams Steel Spec Universal Primer or Tnemec Series 10-99 that complies with the following performance requirement:

1. Abrasion: ASTM D 4060 (CS-17 Wheel, 500 grams load). No more than 30 gram loss After 500 cycles.

2. Adhesion: ASTM D 3359 (Method B, Crosshatch). No less than a rating of 5.

3. Elongation: ASTM D 522 (Method b, Cylindrical Mandrel). Passes 1/8" mandrel with no less than 31% elongation.

4. Salt Spray (Fog): ASTM B 117. No blistering, cracking, rusting or delamination of film. No rust creepage at scribe after 500 hours exposure.

D. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

2.8 PERIMETER STRUCTURAL STEEL - SHOP PRIMING INTERIOR PERIMETER STEEL THAT WILL BE ENCLOSED OR COVERED WITH APPROVED/TESTED SPRAY-APPLIED FIREPROOFING OR FINISH PAINTED. HI-PERFORMANCE SYSTEM #1

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Primer: Immediately after surface preparation, apply to a dry film thickness of 2.5 to 3.5 mils of shop applied Aromatic Polyurethane, Mio-Zinc Filled Primer such as Tnemec Series 394 Perimeprime or Sherwin Williams Recoatable Epoxy Primer at 4.0 to 6.0 mils DFT.

D. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

2.9 SHOP PRIMING INTERIOR AREAS THAT WILL <u>NOT</u> BE EXPOSED TO VIEW OR PAINTED

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials.

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Primer: Immediately after surface preparation, apply to a dry film thickness of 2.0 to 3.5 mils a primer, such as Sherwin Williams Steel Spec Structural Steel Primer or Tnemec Series 88HS Azeron H.S. Primer that complies with all local, state and federal regulations.

D. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

2.10 SHOP PRIMING AND FIELD OR SHOP PAINTING OF STEEL THAT IS EXPOSED TO WEATHER IN THE FINISHED CONFIGURATION OF THE STRUCTURE.

A. Surface Preparation: Clean surfaces to be painted. Remove rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

B. Prime Coat: Immediately after surface preparation, provide one coat of shop applied Organic Zinc Rich Urethane Primer, such as Sherwin Williams Corothane I Galvapac 1K Zinc Primer at 3.0 to 4.0 mils DFT or Tnemec 90-97 at 2.5 to 3.5 mils DFT which meets the following performance requirements:

1. Solids by Volume: 63%

2. Zinc Content: 83% y weight.

3. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.

4. Adhesion: ASTM 4541 – Type V – no less than 2,083 psi(14.36 MPa) pull.

5. Prohesion: ASTM G85 Prohesion Cabinet Testing. 15,000 hours.

6. Cathodic Disbondment: ASTM G8, Method A.

7. Immersion: ASTM D 870 Potable Water Immersion. 7 year exposure.

8. Galvanic Protection: Method: A coated steel panel containing several holidays is placed in a container of tap water. The panels potential is measured by a voltmeter with the positive pole attached to a bare spot on the panel above the water line and the negative pole attached to an Ag/AgCl reference electrode immersed in the tap water. Results: report average potential.

9. AISC Static Fatigue: Primer shall meet requirements of a Class B surface with a mean slip coefficient no less than 0.50 and a tension creep not in excess of .005 inch over SSPC-SP6 prepared substrate.

C. Intermediate Coat: Provide one coat of shop applied Polyamide Epoxy, such as Sherwin Williams Macropoxy 646 Fast Cure Epoxy at 4.0 to 6.0 mils DFT or Tnemec Series 66 Hi-Build Epoxoline at 4.0 to 6.0 mils DFT which meets the following performance requirements:

1. Solids by Volume: 56%

2. Salt Spray (Fog): ASTM B 117, 20,000 hours exposure.

3. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles). No more than 115 mg loss.

4. Adhesion: ASTM 4541 – Type V – no less than 1,930 psi (13.31 MPa) pull.

5. Dielectric Strength: ANSI/ASTM D149.

6. Immersion: ASTM D 870, Zinc primer/epoxy finish, 7 year exposure.

D. Touch-Up Painting/Preparation before Finish Paint: Immediately after erection all surfaces shall be cleaned per SSPC – SP1, SP2, and SP3. Remove all foreign materials and contaminates, clean field welds, bolted connections, and abraded areas of shop paint. All damaged and abraded areas shall have feathered edges. Field touch-up with one coat of Intermediate Coat paint applied at 4.0-6.0 Mils DFT prior to finish coat.

E. Finish Paint: Provide one finish coat of an Aliphatic Acrylic Polyurethane, such as Sherwin Williams Hi-Solids Polyurethne at 3.0 to 5.0 mils DFT or Tnemec Series 1075 Endura-Shield II, at 3.0 to 5.0 mils DFT which meets the following performance requirements:

1. Solids by Volume: 71%

2. Salt Spray (Fog): ASTM B 117, 2,000 hours exposure.

3. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles). No more than 139 mg loss.

4. Adhesion: ASTM 4541 – no less than 1,423 psi(9.81 MPa) pull.

5. Flexibility: ASTM D 522 (Method A) – no less than 14.4% elongation.

6. Hardness: ASTM 3363- no gouging with an HB or less pencil.

7. Humidity: ASTM 4585- 4,000 hours exposure.

8. Impact: ASTM B 2794 – no cracking or delamination of film after 35 inch-pounds direct impact.

9. Prohesion: ASTM G85 – 10,000 hours exposure.

F. Any Field Painting to be brush or roller applied.

2.11 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Ultrasonic Inspection: ASTM E 164.

4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

2. Do not remove temporary lateral bracing and other stability guys and bracing until cast-in-place concrete has attained its design compressive strength, all permanent bracing is in place, and metal roof deck is in place and secured. Metal roof deck and concrete floor slab are required for structural stability.

3. Do not remove temporary lateral bracing and other stability guys and bracing until metal roof deck is in place and secured and all permanent bracing is installed. Metal roof deck is required for structural stability.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "[Specification for Structural Steel Buildings – AISC 360-05."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Weld plate washers to top of base plate.

3. Snug-tighten anchor rods 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 before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel[and architecturally exposed structural steel] within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings – AISC 360-05" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Comply with AISC's "Seismic Provisions For Structural Buildings." Where requirements of said document conflict with these specifications, the more stringent requirement (as determined by the Structural Engineer of Record) shall apply.

3. Remove backing bars or runoff tabs, back gouge, and grind steel smooth. (except as noted in Part 3)

4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

5. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.

b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

3. Clean and touchup surfaces according to the standard or high performance system indicated above.

C. Touchup Painting: Unless noted, cleaning and touchup painting are specified in Division 09 painting Sections.

STRUCTURAL STEEL SUBMITTAL CHECKLIST

This submittal checklist must be provided with all structural and miscellaneous steel packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal unchecked or as revise and resubmit.

STRUCTURAL STEEL SHOP DRAWINGS AND CALCULATIONS		
Included?	**Description**	**Location in project documentation where this requirement is located.**
☐	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05120, Part I, Subsection 1.5
☐	Calculations stamped by an Engineer registered in the state where the project is located.	General Notes- Section 5.0 Spec Section 05120, Part I, Subsection 1.4
☐	Shop drawings include: For each connection, the ***following shall be noted on the shop drawings***: Required design reaction Calculation sheet number for design Capacity of detailed connection **Stamp of Engineer submitting calculations for the connection**	Spec Section 05120, Part I, Subsection 1.5
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05120, Part I, Subsection 1.5
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05120, Part I, Subsection 1.5
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05120, Part I, Subsection 1.5 are included on the checklist.	Spec Section 05120, Part I, Subsection 1.5
ANCHOR BOLT PLACEMENT SHOP DRAWINGS		
Included?	**Description**	**Location in project documentation where this requirement is located.**
☐	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05120, Part I, Subsection 1.5
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05120, Part I, Subsection 1.5
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05120, Part I, Subsection 1.5
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05120, Part I, Subsection 1.5 are included on the checklist.	Spec Section 05120, Part I, Subsection 1.5

MISCELLANEOUS STEEL, STAIR, OTHER SHOP DRAWINGS		
Included?	**Description**	**Location in project documentation where this requirement is located.**
☐	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05120, Part I, Subsection 1.5
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05120, Part I, Subsection 1.5
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05120, Part I, Subsection 1.5
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05120, Part I, Subsection 1.5 are included on the checklist.	Spec Section 05120, Part I, Subsection 1.5
☐	Calculations stamped by an Engineer registered in the state where the project is located.	General Notes- Section 5.0
QUESTIONS, ETC. PER SECTION 05120, PART I, SUBSECTION 1.5		

END OF SECTION 051200

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists.

2. K-series steel joist substitutes.

3. Joist accessories.

B. Related Sections include the following:

1. Division 01 Section 2300 “Alternates” for Steel Joists included in alternates.

2. Division 03 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.

3. Division 05 Section “Structural Steel Framing”

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/240 of the span.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. The contractor shall fill out the Steel Joist Submittal Checklist and include it as part of his shop drawing submittal package. Submittals without the checklist will be returned unchecked as an incomplete submittal. The checklist sheet is located at the end of this specification section.

2. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the checklist. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the checklist and subsequently not explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.

3. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All copies required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

4. Indicate locations and details of bearing plates to be embedded in other construction.

5. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

6. Design Calculations: Submit for record one copy of design calculations, sealed by an engineer registered in the state where the project is located, for joist and joist girders with cantilevers or concentrated loads, joist and joist girders marked “SP”, or joist sizes for which standard load tables are not applicable. Submittals for which these calculations are not included will be returned unchecked or as revise and resubmit.

7. Contract documents shall not be used for shop drawing, including erection plans or details.

8. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.

C. Welding certificates.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

F. Qualification Data: For manufacturer and professional engineer specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Field quality-control test and inspection reports.

H. Research/Evaluation Reports: For joists. Evidence of steel joists' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for

installations of joists that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 COORDINATION

A. Trade contractor shall coordinate steel joist construction requirements with structural steel framing in coordination with Construction Manager.

B. Trade contractor shall coordinate loads of other equipment or materials hanging from or supported by joists with joist manufacturer in coordination with Construction Manager.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM A 780.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

B. Primer: Provide shop primer that complies with Division 09 painting Sections.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Camber joists according to SJI's "Specifications."

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

D. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

E. Steel bearing plates with integral anchorages are specified in Division 05 Section "Metal Fabrications."

F. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

G. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

D. Shop priming of joists and joist accessories is specified in Division 09 painting Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.

2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:

1. Radiographic Testing: ASTM E 94.

2. Magnetic Particle Inspection: ASTM E 709.

3. Ultrasonic Testing: ASTM E 164.

4. Liquid Penetrant Inspection: ASTM E 165.

D. Bolted connections will be visually inspected.

E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

3. At the apparatus bay, clean and touch up surfaces per the structural steel high-performance system #3 listed above.

A. Touchup Painting: Unless noted, cleaning and touchup painting are specified in Division 09 painting Sections.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

STEEL JOIST SUBMITTAL CHECKLIST

This submittal checklist must be provided with all steel joist packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal unchecked or as revise and resubmit.

STEEL JOIST SHOP DRAWINGS AND CALCULATIONS		
Included?	**Description**	**Location in project documentation where this requirement is located.**
☐	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05210, Part I, Subsection 1.5
☐	Special Joist and Joist Girder Calculations stamped by an Engineer registered in the state where the project is located.	General Notes - Section 2.0 Spec Section 05210, Part I, Subsection 1.5
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05210, Part I, Subsection 1.5
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05210, Part I, Subsection 1.5
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05210, Part I, Subsection 1.5 are included on the checklist.	Spec Section 05210, Part I, Subsection 1.5
QUESTIONS, ETC. PER SECTION 05210, PART I, SUBSECTION 1.5		

END OF SECTION 052100

SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.

2. Composite Metal deck.

B. Related Sections include the following:

1. Division 01 Section 2300 “Alternates” for Steel Decking included in alternates.

2. Division 03 Section "Cast-in-Place Concrete" for concrete fill.

3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.

4. Division 05 Section “Steel Joist Framing”

5. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

6. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1. The contractor shall fill out the Steel Deck Submittal Checklist and include it as part of his shop drawing submittal package. Submittals without the checklist will be returned unchecked as an incomplete submittal. The checklist sheet is located at the end of this specification section.

2. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the checklist. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the checklist and subsequently explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.

3. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All copies required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

4. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.

5. Design Calculations: Submit for record one copy of design calculations, sealed by an engineer registered in the state where the project is located, for joist and joist girders with cantilevers or concentrated loads, joist and joist girders marked “SP”, or joist sizes for which standard load tables are not applicable. Submittals for which these calculations are not included will be returned unchecked or as revise and resubmit.

6. Contract documents shall not be used for shop drawing, including erection plans or details.

7. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

G. Mechanical fasteners.

H. Research/Evaluation Reports: For steel deck. Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.6 COORDINATION

A. Coordinate steel decking with structural steel and cold formed metal framing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:

a. Canam Steel Corp.;The Canam Manac Group.

b. Consolidated Systems, Inc.

c. D-Mac Industries Inc.

d. Epic Metals Corporation.

e. Marlyn Steel Decks, Inc.

f. Nucor Corp.; Vulcraft Division.

g. Roof Deck, Inc.

h. United Steel Deck, Inc.

i. Valley Joist; Division of EBSCO Industries, Inc.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.

2. Deck Profile: Type WR, wide rib or Type DR, deep rib, unless noted.

3. Profile Depth: 1-1/2 inches (38 mm).

4. Design Uncoated-Steel Thickness: See Plans

5. Span Condition: Triple span or more.

6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60 zinc coating.

2. Profile Depth: 2 inches.

3. Design Uncoated-Steel Thickness: see plans

4. Span Condition: As indicated.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile [indicated] [recommended by SDI Publication No. 30 for overhang and slab depth].

H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

K. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

L. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer, unless noted. At Apparatus Bay, see structural steel high-performance system #3 listed above for primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal at structural steel or joist framing; #12 TEK Screws at cold formed metal framing.

2. Fastener Spacing: Fasten edge and interior ribs of deck units with a minimum of two fasteners per deck unit at each support with fastener spacing not exceeding 12 inches (305 mm) apart in the field of roof unless noted, or as indicated in drawings.

3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (910 mm) unless noted, or as indicated in drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

2. Mechanically clinch or button punch.

3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.

2. Fastener Spacing: Fasten edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.

3. Weld Spacing: Space and locate welds as indicated.

4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

2. Mechanically clinch or button punch.

3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

STEEL DECK SUBMITTAL CHECKLIST

This submittal checklist must be provided with all steel deck packages that are to be submitted to Structural Design Group. Absence of a properly completed checklist may result in the return of the submittal unchecked or as revise and resubmit.

STEEL DECK SHOP DRAWINGS AND CALCULATIONS		
Included?	**Description**	**Location in project documentation where this requirement is located.**
☐	Submit all shop drawings on one reproducible print and two reproductions only.	General Notes - Section 2.0 Spec Section 05310, Part I, Subsection 1.3
☐	Contract documents not used for shop drawing, including erection plans or details	Spec Section 05310, Part I, Subsection 1.3
☐	Resubmitted shop drawings have all revised items clouded or identified.	Spec Section 05310, Part I, Subsection 1.3
☐	Any requested information, clarifications, requests for approvals, modifications, etc. as listed in Spec Section 05310, Part I, Subsection 1.3 are included on the checklist.	Spec Section 05310, Part I, Subsection 1.3
QUESTIONS, ETC. PER SECTION 05310, PART I, SUBSECTION 1.3		

END OF SECTION 05 3100

SECTION 05 4000 - COLD-FORMED STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes Design and or Build work of the following:
   1. Exterior load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.
   3. Interior load-bearing wall framing.
   4. Roof trusses
      a. Gable-shaped trusses
      b. Piggyback Trusses.
   5. Roof rafter framing.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, steel-stud framing and ceiling-suspension assemblies.
   3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, steel-stud-framed, shaft-wall assemblies.

C. The extent of cold-formed steel framing is shown on the drawings, including notes, elevations and details to show basic layout and location of members, typical connections, and type of steel required.

D. Section includes all work and supplementary items required to complete the proper installation of the cold-formed steel framing and pre-engineered cold-formed steel framing as shown on the drawings and specified herein including headers, outriggers, supplemental rafters and incidental framing for a cold-formed steel framing assembly within the extent shown on the drawings.

E. Cold-formed steel framing includes planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated. Design bridging and other temporary and permanent bracing for same loads as used to design cold-formed steel framing plus any temporary loads and permanent loads resulting from lateral bracing of members.
   1. Engineering Responsibility: Manufacturer’s responsibilities include using a qualified professional engineer to prepare structural analysis data for cold-formed steel framing. All cold-formed steel framing not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State where the project is located. Engineer/firm shall provide proof of professional liability insurance for said engineering responsibility. Engineering cost to be borne by Manufacturer.
      a. Design calculations for the cold-formed steel framing designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State where the project is located. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.
      b. Roof Trusses and Rafter Framing: Engineering provided by manufacturer shall be a complete package similar to the “Works” package provided by Aegis Metal Framing or equal. Package to include at a minimum, but not limited to the following:

1) Professional Engineer seal on shop drawings and calculations.
2) Design of all trusses including special trusses such as drag strut trusses, blocking trusses and eave blocking to resist lateral load specified to be transferred from the roof diaphragm to the structural system.
3) All truss to truss connections and all trusses to support connections.
4) Permanent Bracing layout diagrams with connection requirements showing bracing sections and details.
5) Construction Bracing (lateral and diagonal) Layout Diagrams for bottom chord plane, web plane and top chord plane showing bracing sections and details.
6) Minimize Construction Bracing by incorporating Permanent Bracing into the construction bracing where possible.
7) Also as indicated in drawings.

2. Design Loads: As follows:
   a. Dead Loads: As indicated in drawings.
   b. Live Loads: As indicated in drawings.
   c. Wind Loads: As indicated in drawings.
   d. Seismic Loads: As indicated in drawings.
   e. Loads indicated on drawings plus concentrated loads hung from or supported on trusses. Refer to mechanical, electrical and plumbing drawings and specifications for loading information and location. Loading as required by other subcontractors, such as fire protection, shall be coordinated by the General Contractor.
   f. Submit design load criteria prior to completing design calculations to confirm/ensure understanding of load criteria and to avoid redesign and schedule delays.
3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than indicated in drawings.
   a. Roof Rafter Framing: Horizontal deflection limit to be based on the horizontally projected span.
4. Wall Stud Spacing Limit: Maximum spacing of interior and exterior wall studs to be 16”o/c.
5. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (49 deg C).
6. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1/2 inch (13 mm).
7. Holes in Members: Design for holes in members where shown for securing other work to trusses; however, deduct area of holes from the area of chord when calculating strength of member.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.04 SUBMITTALS

A. The roof truss and rafter framing system are ‘Total Design and or Build’ construction delivery systems and review of submittals by the Owner or his representative does not relieve the ‘Design and or Build’ Contractor of design duties, construction responsibility or liability for improper design, function or performance. The review by Owner is not an independent design check of final plans and methods of

construction by and will not in any way relive the 'Design and or Build' contractor of sole design and construction responsibility for the successful completion and long-term stability of the work.

B. Product Data: For each type of cold-formed steel framing product and accessory indicated. Submit manufacturer's product literature, data sheets and installation recommendations for specified products each type of cold-formed steel framing item required.

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, pitch, span, camber and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Shop drawings shall include all placement sequences and instructions.
   1. Submit all shop drawings electronically. Electronic copies will be returned to the Architect. Reproductions required by the Contractor are the responsibility of the Contractor and shall be made after electronic copy is returned.
   2. Architect's and Engineer's Shop Drawing Review: Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, engineering, dimensions, bracing, and erection is the Contractor's responsibility.
   3. If there are questions, clarifications, modifications, or other items where information, a response, or approval is requested, such items must be written on the cover sheet to the submittal. Only indicating such items on the shop drawings or within the calculations is not sufficient. Where items are not specifically listed on the cover sheet and subsequently explicitly approved by the Structural Engineer of Record, such items are not to be considered approved or considered.
   4. Submit design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to insure CFS systems comply with requirements.
   5. For cold-formed steel framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation licensed to practice in the state where the project is located. Shop drawings which do not contain this information will be returned unchecked.
   6. Submittals shall additionally conform to the requirements shown on the General Notes of the project Structural Drawings.
   7. Submit roof truss and rafter framing shop drawings showing, but not limited to:
      a. Professional Engineer seal on shop drawings and calculations.
      b. All trusses including special trusses such as drag strut trusses, blocking trusses and eave blocking to resist lateral load specified to be transferred from the roof diaphragm to the structural system.
      c. All truss to truss connections and all trusses to support connections.
      d. Permanent Bracing layout diagrams with connection requirements showing bracing sections and details.
      e. Construction Bracing (lateral and diagonal) Layout Diagrams for bottom chord plane, web plane and top chord plane showing bracing sections and details.
      f. Coordinate other trades with roof trusses not limited to piping, ductwork, mechanical units, vents, electrical, cabling, misc. cold-formed steel framing, eave vents, roofing, etc.
   8. Shop Drawings & Coordination: Submit wall panel drawings for panels showing panel layout, elevation, material and location. Provide drawings depicting panel configurations, dimensions and locations to coordinate with other suppliers of the following to determine necessary opening sizes, attachments and other requirements:
      a. Coordinate connections through floor decking and associated concrete ring beams, sequence of connection provisions including anchorage holes, thru-floor connections, etc.
      b. Windows/ Louvers: Window and louver sizes, masonry opening sizes, sealant joint size, louver sizes, mounting height of window/louver assembly.

c. At Doors: Opening size requirements including post-setting of frames and necessary tolerances.
d. Miscellaneous Items at Exterior Walls: Electrical receptacles, wall hydrants, etc.
e. Verification: Provide information illustrating verification of these items as part of shop drawing process.
f. Coordinate other trades with wall panels not limited to structural steel, piping, ductwork, mechanical units, vents, electrical, cabling, misc. cold-formed steel framing, wall construction types, etc.

9. Submit Shop Drawings and Submittals within 40 days of "Notice to Proceed".
10. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer (including Proof of professional liability insurance for Professional engineer) agency and testing

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors shall not be used.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

G. Research/Evaluation Reports: For cold-formed steel framing.

H. Quality Assurance Plan of Action: Submit Quality Assurance Plan of Action for Cold-formed steel framing prior to submission of Shop Drawings.

I. Structural Calculations: Submit structural calculations prepared by the cold-formed steel manufacturer for approval by the Architect and Engineer of Record. Submittal shall be sealed by a professional engineer registered in the state of the project. Calculations shall include at a minimum the following:
1. Description of design criteria.
2. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
3. Selection of framing components, accessories and connection requirements.
4. Verification of attachments to structure and adjacent framing components.
5. Engineer shall have a minimum of 5 years of experience with projects of similar scope.

1.05 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed steel framing that are similar to those indicated for this Project in material, design, and extent.

C. Fabricator's Qualifications: Cold-formed steel framing shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully designing, fabricating, and erecting cold-formed steel framing assemblies similar to scope required and which practices a quality control program (see Quality Assurance Plan of Action below) and/or is approved to perform such work without special inspection, such as certification by an approved independent agency that conducts in-house inspections, such as Structural Building Components (SBC), Cold-formed Steel Council (CFSC),

SSMA (Steel Stud Manufacturer's Association) Code Compliance Certification Program or Steel Framing Alliance in accordance with IBC Section 1704.2.5.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

E. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

F. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel." Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
   2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two-Family Dwellings."

I. Not used

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Verify project requirements, substrate conditions, and manufacturer's installation instructions.
   1. The Contractor shall coordinate with the concrete subcontractor and the CFS wall panel manufacturer the anticipated tolerances between the two systems and potential retrofits to related issues.
   2. All slab edge misalignments, top of slab elevation variations, mis-located embed plates at hold down locations, etc., even those that are within ACI tolerances, are the responsibility of the contractor to correct and must accommodate the CFS wall panel system. Examples of such retrofit include but are not limited to the following: concrete slab grinding, shimming and grouting under wall panels, embed plate repairs, slab edge retrofit, etc.

K. Quality Assurance Plan of Action:
   1. General:
      a. Certified Fabricators: Submit certification and audit documentation for fabrication procedures indicating fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricators ability to conform to approved construction documents and referenced standards. Audit shall comply with IBC requirement 1704.2 for special inspection of fabricators.
      b. Non-Certified Fabricators: Coordinate with Owner's special inspector for review of quality control procedures and periodic special inspections of plant fabrication.
   2. Roof Trusses: For shop or field fabricated roof trusses provide written documentation (Quality Assurance Plan of Action) of procedures to fabricate and install structural components indicated in approved construction documents and approved shop drawing submittal. Include in plan, procedure for coordinating roof truss bearing locations and connections to wall panels with wall panel manufacturer.
   3. Wall Panels: For shop-fabricated wall panels provide written documentation (Quality Assurance Plan of Action) of procedures to fabricate and install structural components indicated in approved construction documents and approved shop drawing submittal. Include in plan, procedure for coordinating other components related to wall panels (anchor bolts, embed plates,

hold down anchor/brackets, etc.) related to the wall panels that must be installed into or thru other trade's products such as slab on grade, concrete podium slab, composite steel deck beam and slab, etc.

L. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed steel framing, protect with a waterproof covering, and ventilate to avoid condensation.

C. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

D. Deliver materials in manufacturer's original, unopened, undamaged containers or bundles, fully identified by name, brand, type and grade with identification labels intact.

E. Store materials off the ground with sufficient bracing to avoid damage from excessive bending.

1.07 REFERENCES

A. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

B. ASTM A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

C. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

D. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

E. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

F. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

H. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

I. AISC - Steel Construction Manual.

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

K. AWS D.1.3 - Structural Welding Code - Sheet Steel.

1.08 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. During construction, adequately distribute all construction loads applied to floor so as not to exceed the carrying capacity of any one member or joist or other component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers (Fabricators): Subject to compliance with requirements, manufacturers offering cold-formed steel framing that may be incorporated into the Work include, but are not limited to, the following:
1. Dsi Structures
2. Steel Construct Systems
3. Builders First Source (trusses only)
4. Steelway International
5. Odum Construction Systems
6. FL Crane (walls only)
7. Raney Truss (trusses only)
8. United Structures
9. Panel Steel, Inc. (walls only)
10. Panel Systems, Inc.
11. Precision Walls, Inc. (walls only)
12. CF Steel (trusses only)
13. Proffitt & Sons, Inc.
14. Drywall Systems Plus (walls only)

B. Manufacturers: Subject to compliance with requirements, provide cold-formed steel framing by one of the following:
1. Clark Dietrich Steel Framing.
2. MarinoWare; a division of Ware Industries.
3. Aegis Metal Framing, a division of MiTek
4. The Steel Network, Inc.
5. Trussteel by Alpine
6. Steeler Inc.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: Minimum of Grade 33 or as required by structural performance.
2. Coating: G60 (Z180), complying with ASTM C 955.

B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50 (340), Class 1 or 2 or as required by structural performance.
2. Coating: G90 (Z275), complying with ASTM C 955.

2.03 EXTERIOR LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or matching steel studs.

2. Minimum Flange Width: 1-1/4 inches (32 mm).
3. Section Properties: as required by structural performance.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm.
2. Minimum Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

D. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Top Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

2.04 INTERIOR LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or matching steel studs.
2. Minimum Flange Width: 1-1/4 inches (32 mm).
3. Section Properties: as required by structural performance.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm.
2. Minimum Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

D. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Top Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

2.05 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows unless noted otherwise in drawings:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or matching steel studs.
2. Minimum Flange Width: 1-1/4 inches (32 mm)].
3. Section Properties: as required by structural performance.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.
   3. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
   4. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

E. Contractors' Option Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
      b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
      b. Flange Width: outer deflection track flange width plus 1 inch (25 mm).

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.06 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections, C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges.
   1. Minimum Base-Metal Thickness: as required by structural performance.
   2. Flange Width: as required by structural performance.
   3. Section Properties: as required by structural performance.

2.07 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).

2. Flange Width: 1-5/8 inches (41 mm) minimum.
3. Section Properties: as required by structural performance.

B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section rafter track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) or Matching steel rafters.
2. Flange Width: 1-5/8 inches (41 mm, minimum.

2.08 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Shim plates.
9. Stud kickers, knee braces, and girts.
10. Rafter hangers and end closures.
11. Hole reinforcing plates.
12. Backer plates.
13. U-Channel
14. Bridging/Spacer Bar
15. Flat Strapping.
16. Angles, Plates, Sheets.
17. Custom Brake-Formed Shapes.

2.09 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws. Corrosion coating shall be galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.010 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: Zinc rich, containing 95-percent metallic zinc, ZRC 350 as manufactured by ZRC Worldwide, Marshfield, MA.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, non-leaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.011 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
      a. Roof trusses shall be shop fabricated.
      b. Wall panels shall be shop fabricated.
   2. Cut framing members by sawing or shearing, shearing or plasma cutting; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted. Wall panels shall be fastened by means of welding or preapproved machine dimpled screw system.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, or screw fastening, according to Shop Drawings.
   5. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track using a press.
      a. Weld track to stud while wall panel is still in the press.
   6. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

D. If cold-formed steel framing is shop fabricated, fabricate in the largest sections possible to transport and erect.

E. All cold-formed steel framing shall be fabricated and erected in strict accordance with the current printed instructions of the approved subcontractor or fabricator.

F. All cold-formed steel framing components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.

G. All cold-formed steel framing components shall be cut neatly to fit snugly against adjacent members. Hold members positively in place until properly fastened.

H. No splices will be allowed in cold-formed steel framing except as authorized in writing by the Architect or as shown on the approved shop drawings.

I. Non-load bearing framing components shall be field or shop fabricated and joined to one another by means of welding or through the use of screws.

J. Load bearing Exterior and Interior wall panels shall be shop fabricated and joined by means of welding or preapproved machine dimpled screw system.

K. Completed cold-formed steel framing shall be free from twists, bends, or open joints with all members straight and true to line.

L. Welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.

M. Bridging: Fabricate horizontal or diagonal type bridging for cold-formed steel framing as required to prevent buckling of members where sheathing applied to the cold-formed steel framing members is not present or is not adequate to brace the cold-formed steel framing member. Bridging shall transfer all forces to the roof diaphragm.

1. Where solid blocking is provided, ensure adequate travel way clearances for mechanical, electrical, and plumbing for full height of wall via pre-punched slots, drilled holes, etc.

N. End Anchorage: Fabricate end anchorages to secure cold-formed steel framing to adjacent construction.

O. Fabricate all clips, angles, henways and other miscellaneous pieces necessary to attach cold-formed steel framing to the substructure or to attach other components within this section to one another.

P. Provide insulation as specified elsewhere in all jamb stud groups and double header members, which will not be accessible to the insulation contractor.

Q. Fabricate wall panels in a controlled environment, protected from exposure to harmful weather conditions and free from dirt or other foreign matter.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, abutting structural framing and all other trades for compliance with requirements for installation tolerances and other conditions affecting performance.

1. All slab edge misalignments, top of slab elevation variations, mis-located embed plates at hold down locations, etc., even those that are within ACI tolerances, are the responsibility of the contractor to correct and must accommodate the CFS wall panel system. Examples of such retrofit include but are not limited to the following: concrete slab grinding, shimming and grouting under wall panels, embed plate repairs, slab edge retrofit, etc. Submit applicable solutions for review.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
3. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
4. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PREPARATION

A. Structural Adequacy: Contractor shall prepare the structure to insure proper and adequate structural support for the materials specified.

B. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

C. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

D. Install load bearing shims and grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or rafter locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.03 INSTALLATION, GENERAL

A. Non-load bearing cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled. Load bearing cold-formed steel framing shall be shop fabricated and installed in the field.

B. Install cold-formed steel framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions", manufacturer's written instructions and ASTM C1007 unless more stringent requirements are indicated.

C. Install cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
      c. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track using a press.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed rafters, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

K. Weld in compliance with AWS D.1.3.

3.04 WALL SYSTEMS: INSTALLATION

A. Erect framing and panels plumb, level and square in strict accordance with approved shop drawings.

B. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.

C. Anchor track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.

D. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or butt-weld or splice them together.

E. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.

F. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.

G. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.

H. Frame wall openings to include headers and supporting studs as shown in the drawings.

I. Provide temporary bracing until erection is completed.

J. Provide stud walls at locations indicated on plans as “shear walls with x-strapping” for frame stability and lateral load resistance.

K. Where indicated in the drawings, provide for structural vertical movement using a vertical slide clip or other means in accordance with manufacturer’s recommendations.

3.05 EXTERIOR AND INTERIOR LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: To match stud spacing.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track using a press. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
   1. Stud Spacing: 16 inches (406 mm) Maximum Spacing.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced a minimum of 48 inches (1220 mm) apart or as required by structural performance. Fasten at each stud intersection.
1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
a. Where solid blocking is provided, ensure adequate travel way clearances for mechanical, electrical, and plumbing for full height of wall via pre-punched slots, drilled holes, etc.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.06 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches (406 mm) Maximum Spacing.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows but not more than 48 inches (1220 mm) apart or as required by structural performance. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
a. Install solid blocking at 96-inch (2440-mm) centers.
2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    a. Where solid blocking is provided, ensure adequate travel way clearances for mechanical, electrical, and plumbing for full height of wall via pre-punched slots, drilled holes, etc.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.07 ROOF RAFTER INSTALLATION

A. Install perimeter rafter track sized to match rafters. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install rafter bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten rafters to both flanges of rafter track.
1. Install rafters over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of rafters with web stiffeners, end clips, rafter hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space rafters not more than 2 inches (51 mm) from abutting walls, and as follows:
1. Rafter Spacing: 24 to 48 inches or as required by structural performance.

D. Frame openings with built-up rafter headers consisting of rafter and rafter track, nesting rafter, or another combination of connected rafters if indicated.

E. Install rafter reinforcement at interior supports with single, short length of rafter section located directly over interior support, with lapped rafters of equal length to rafter reinforcement.
1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals as required by structural performance Fasten bridging at each rafter intersection as follows:
1. Bridging: Rafter-track solid blocking of width and thickness indicated, secured to rafter webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and rafter-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of rafters and secure solid blocking to rafter webs.

G. Secure rafters to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous rafter framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable rafter-framing assembly.

3.08 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: 48 inches (1220 mm), unless shown otherwise.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanently brace trusses as required by structural performance and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

H. Trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in any member.

I. All trusses shall be erected using equipment of adequate capacity to safely perform the work.

J. The General Contractor is responsible for checking the dimensions and assuring the fit of all members and trusses before erection begins.

K. All work shall be erected plumb and level and to dimensions and spacings indicated on the drawings. Provide bridging as shown in the shop drawings.

L. Assemblies shall be of the size and spacing shown on the approved shop drawings.

M. Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

N. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members.

O. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

P. Anchor trusses securely at all bearing points to comply with methods and details indicated.

Q. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand design loads, and comply with other indicated requirements.

R. Do not cut or remove truss members.

S. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

T. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening.

3.09 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform shop and or special inspections and prepare test reports per Specification Section 01 4100.
   1. Submit schedule showing when the following activities will be performed and resubmit schedule when timing changes.
   2. Notify inspection agency not less than 3 days before the start of any of the following activities.
   3. Inspections are required during welding operations, screw attachment, bolting, anchoring and other fastening of components within the force resisting structural system, including struts, braces, and hold-downs.

B. Field and shop welds will be subject to testing and inspecting.

C. Provide Access for testing agency to places where truss work is being fabricated or produced so that required inspections, observations and testing can be accomplished.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements regardless of when testing agency completed inspection, observation or testing.

3.010 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Prefabricated ladders.

C. Miscellaneous structural items.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry Assemblies: Placement of metal fabrications in masonry.

C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

F. Section 05 5213 - Pipe and Tube Railings.

G. Section 09 9000 - Painting and Coating: Field Paint finishing.

H. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

I. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

L. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

M. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

O. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019.

P. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

Q. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2014.

R. ASTM B85/85M - Standard Specification for Aluminum-Alloy Die Castings; 2014.

S. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.

T. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

U. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

V. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

W. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

X. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

Z. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

AA. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

AB. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

AC. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

AD. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each prefabricated system, or product to be used, including installation instructions.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Engineering analysis depicting stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections.
         5) Support reactions.
         6) Bracing requirements.

1.05 QUALITY ASSURANCE

A. Design shall be performed under direct supervision of a Professional Engineer experienced in design of this work and licensed in Alabama and whom shall be retained by the General Contractor, its supplier, or fabricator.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 80, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type II - Organic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Bumper Posts and Guard Rails: As detailed; galvanized finish.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of masonry; galvanized finish.

D. Lintels: As detailed; galvanized finish.

E. Door Frames for Wall Openings: Channel sections; galvanized finish.

F. Mud and Foot Grilles and Pans: As detailed; aluminum, mill finish.

2.05 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with factory fabrication to greatest degree practical and in the largest components possible.
   1 Other Acceptable Manufacturers
      a. Precision Ladders, LLC. product SL Series: www.precisionladders.com.

2.06 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry and where exposed to corrosive environments.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: Two coats.

E. Galvanizing of Structural Steel Members: Hot dip Galvanized after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized, or high performance coated as selected by Architect .

B. Interior Aluminum Surfaces: Class I color anodized, or finished with a Pigmented Organic Coating AAMA 2603 polyester or acrylic baked enamel as selected by the Architect.

C. Pigmented Organic Coating System: AAMA 2603 polyester or acrylic baked enamel finish; color as indicated.

D. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

E. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION 05 5000

SECTION 05 5213

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Free-standing railings at handicap ramp.

B. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 2000 - UNIT MASONRY ASSEMBLIES: Placement of anchors in masonry.

C. Section 05 5100 - Metal Stairs: Attachment plates for handrails specified in this section.

D. Section 06 2000 - Finish Carpentry: Wood handrail.

E. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings:
   1 American Stair Corporation: www.americanstair.com
   2 Sharon Stairs: www.sharonstair.com..
   3 Local or Regional Fabricator subject to approval by Architect as follows:.
      a. NAAMM member .
      b. AISC Certification
   4 Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs at any point without damage or permanent set. Test in accordance with ASTM E 935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Dimensions: See drawings for configurations and heights.

E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1 For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2 For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3 For anchorage to stud walls, provide backing plates, for bolting anchors.

F. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Straight Splice Connectors: Steel welding collars.

F. Galvanizing: In accordance with requirements of ASTM A123/A123M.
   1 Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Paint as indicated in Section 09 9000

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured.

D. Welded Joints:
   1 Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2 Interior Components: Continuously seal joined pieces by continuous welds.
   3 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Field weld anchors as indicated on "Approved for Field Use" shop drawings. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 3/16_ inch.

3.05 SCHEDULE-SEE DRAWINGS

END OF SECTION

SECTION 05 7000

ARCHITECTURAL METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative stair Railings.

B. Railing and guardrail assemblies.

C. Wall-mounted handrails.

D. Free-standing railings at Accessible Roof areas, walks and balconies.

E. Site railing with internally illuminated top rail.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-place Concrete.

B. Division 04 0000 - Masonry: Attachments and embeds for installation in Unit Masonry assemblies, Concrete

C. Section 05 5000 - Metal Fabrications: Supports and anchors.

D. Section 05 5100 - Metal Stairs: Handrails other than those specified in this section.

E. Section 08 8000 - Glazing: Laminated glass railing.

F. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

I. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

L. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

M. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2015.

N. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2016.

O. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

P. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

Q. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

R. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

S. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

T. ASTM B135 - Standard Specification for Seamless Brass Tube; 2011.

U. ASTM B138/B138M - Standard Specification for Manganese Bronze Rod, Bar, and Shapes; 2011.

V. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

W. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

X. ASTM B248 - Standard Specification for General Requirements for Wrought Copper and Copper Alloy Plate, Sheet, Strip, and Rolled Bar; 2012.

Y. ASTM B248M - Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric); 2012.

Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

AA. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2015.

AB. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

AC. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

AD. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

AE. AWS C3.4M/C3.4 - Specification for Torch Brazing; 2007.

AF. AWS C3.5M/C3.5 - Specification for Induction Brazing; 2007.

AG. AWS C3.9M/C3.9 - Specification for Resistance Brazing; 2009.

AH. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

AI. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
   1. Contractor.
   2. Manufacturer's representative.
   3. Architect.
   4. Owner's representative.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, anchors, and accessories.

C. Engineered Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
   1. All Eng8ineering Design Documents shall bear the seal of the Structural Engineer responsible for their preparation who is licensed in the sate of Alabama.

D. Samples: Submit one (1) of each item below for each type and condition shown.
   1. Railing: 12 inch long section of handrail illustrating color, finish and connection detail.
   2. Infill : 6 inch by 6 inch sample of infill, illustrating design and finish.

E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

F. Manufacturer's Installation Instructions.

G. Maintenance Data: Manufacturer's instructions for care and cleaning.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Delegated Design Responsibility: Engineering Design shall be performed, or directly supervised by the Professional Structural Engineer with current licensure in the State of Alabama.

B. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.

C. Templates: Supply installation templates, reinforcing and required anchorage devices.

1.07 MOCK-UP

A. Provide mockup of stair/balcony railing system, wall-mounted rail, roof terrace rail, lighted site railing.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate where directed.

D. Mock-up may not remain as part of the Work, but may be reinstalled as part of the complete system if stored properly and is in new condition at the time of permanent installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover, in a dry location.

1.09 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.10 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Railing Systems: Basis of Design
   1. Livers Bronze Co., Product Mirage System, pre-engineered component based railing system: Configured as shown on Drawings www.liversbronze.com.
      a. Type 1: Interior: Stair #04 and Commons Balconies: Livers Button Rail glass system as shown (with "brick" mount).
      b. Type 2: Interior: Stair #05, 06 and Multipurpose Room Mezzanine: Livers Mirage Stainless Steel Post System with glass infill, and wall-mounted railing.
      c. Type 3: Exterior: Stair #07 and Accessible Roof Terrace at Level 4 and 5: Livers Mirage Stainless Steel Post System with horizontal rod infill. Provide illuminated top rail at Stair #07.
      d. Type 4: Exterior: Site - miscellaneous railngs: Livers Illume Linear - Stainless Steel post and top rail system.

B. Other Acceptable ManufacturersSubject to Compliance with Requirements.
   1. C. R. Laurence Company, Inc: www.crl-arch.com/sle.
   2. SC Railing Company: Architectural Railings.
   3. Q-Rail; www.q-railing.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Design Criteria: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
      a. Lateral Force: 200 lb minimum, at any point, when tested in accordance with ASTM E935.
      b. Distributed Load: 100 lbs/ft minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
      c. Concentrated Loads on Intermediate Rails: 50 psf, minimum.
      d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
      e. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   2. Assembly: Join lengths, seal open ends, and conceal exposed fastening using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
   3. Joints: Tightly fitted and secured, machined smooth with flush, hairline seams.
   4. Field Connections: Provide post sleeves to accommodate site assembly and installation.
   5. Welded and Brazed Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to specified finish.
      a. Ease exposed edges to small uniform radius.
      b. Welded Joints:
         1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
         2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
      c. Brass/Bronze Brazed Joints:
         1) Perform torch brazing in accordance with AWS C3.4M/C3.4.
         2) Perform induction brazing in accordance with AWS C3.5M/C 3.5.
         3) Perform resistance brazing in accordance with AWS C3.9M/C3.9.

B. Structural Glass Railing System: Engineered, base suported infill component of railing system with structural glass.
   1. See Section 08 8000 - Glazing.

2. Configuration: As shown on drawings.

2.03 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Tubing: ASTM A501/A501M structural tubing, round and shapes as indicated.
   3. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
   4. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   5. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
   6. Iron Castings: ASTM A47/A47M, malleable.
   7. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
   8. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

B. Stainless Steel Components:
   1. ASTM A666, Type 304.
   2. Stainless Steel Tubing: ASTM A554, Type 304, 16 gage, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.
   3. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
   4. Stainless Steel Finish: No. 4 Bright Polished finish.

2.04 ACCESSORIES

A. Non-Weld Mechanical Fittings for Stainless Steel Railings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

C. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
   3. For anchorage to stud walls, provide backing plates for bolting anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

D. Carbon Steel Bolts and Nuts: ASTM A307.

E. Hydraulic Expansion Cement: ASTM C1107/C1107M.

F. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015 inch dry film thickness per coat.

G. Sealant: Silicone; black.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Protect existing work.

B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.

C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections and abraded areas.
   4. Touch up shop primer and factory applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, or 12 feet, non-cumulative.

B. Maximum Offset From True Alignment: 1/8 inch.

C. Maximum Out-of-Position: 1/8 inch.

3.05 FIELD QUALITY CONTROL

A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

C. Refinish, or replace components which are scratched, dented or otherwise damaged.
   1. CRemove components and return to fabrication facility for refinishing, do not refinish in field without documented approval

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonstructural dimension lumber framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Roofing nailers.

D. Fire retardant treated wood materials.

E. Miscellaneous framing and sheathing.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

C. Section 07 6200 - Sheet Metal Fabrications, Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

H. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.

I. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

J. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

K. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

L. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.

M. PS 1 - Structural Plywood; 2009.

N. PS 20 - American Softwood Lumber Standard; 2010.

O. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.

P. SPIB (GR) - Grading Rules; 2014.

Q. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.

R. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Samples: For rough carpentry members that will be exposed to view, submit two samples, full width and thicknessby24 inches inch in size illustrating wood grain, color, and general appearance.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

C. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.06 QUALIFICATIONS

A. Design structural site fabricated wood structural items under direct supervision of a Professional Structural Engineer experienced in design of such items and licensed in Alabama.

1.07 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Trusses: Protect pre-engineered, shop fabricated trusses from warping or other distortion by stacking in vertical position, braced to resist movement.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

C. Provide five year manufacturer warranty for treated wood products.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber sawn from old growth timber is not permitted.

C. Provide wood harvested within a 500 mile radius of the project site; see Section 01 6000 for requirements for locally-sourced products.

D. Lumber fabricated from recovered timber is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 CONSTRUCTION PANELS

A. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, square long edges, 1/2 inch.
   1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   2. Edges: Square.
   3. Glass Mat Faced Products: Basis of Design:
      a. Georgia-Pacific Gypsum; DensDeck Prime Sheathing.
      b. Substitutions: See Section 01 6000 - Product Requirements

B. ½" Fire rated treated plywood for communication and electrical room mounting boards.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment (FRT): NOTE: FRTW requirement applies to all interior wood applications including mounting backboards and concealed in wall blocking and limited, also, concealed or weather protected supplemental support for exterior cladding materials such as metal panels.
   1. Products:
      a. Lonza Group: www.wolmanizedwood.com
      b. Hoover Treated Wood Products, Inc: www.frtw.com
      c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants..

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, cabinets, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.

2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.07 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.08 CLEANING

A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.

B. Do not leave wood, shavings, sawdust, etc. on the ground.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

3.11 SCHEDULES SEE DRAWINGS

END OF SECTION 06 1000

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

C. Standing and Running Trim

D. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 08 1416 - Flush Wood Doors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

G. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

H. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

I. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

K. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2011.

L. PS 1 - Structural Plywood; 2009.

M. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork; 2013.

N. WI (MAN) - Manual of Millwork; Woodwork Institute; 2003.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Include certification program label.

D. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details,

accessories, to a minimum scale of 1-1/2 inch to 1 ft.

E. Samples: Submit two samples of specified finish.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom grade, except as noted otherwise.

B. Grade materials in accordance with the following:
   1. Softwood Lumber: In accordance with rules certified by ALSC; www.alsc.org.
   2. Plywood: Certified by the American Plywood Association.
   3. Hardwood Lumber: In accordance with NHLA Grading Rules; www.natlhardwood.org.

C. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum 10 years of documented experience.
   1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   3. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 MOCK-UP

A. Provide mock-up of approximately 10 linear feet, full size, illustrating construction and finish where directed.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver shop finished units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items in indoor conditioned space, and in a dry, not exposed to temperature extremes or weather.

C. Protect from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   1. Species: White Oak, rift-sawn.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: White Oak species, rift sawn, maximum moisture content of 6 percent of quality suitable for stained finish.

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Hardwood Plywood: Face species as indicated, rift cut, book matched, medium density fiberboard core; glue type as recommended for application.

C. Particleboard: ANSI A208.1; Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

D. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick,

smooth one side (S1S).

E. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/8 inch thick, with holes spaced at 1 inch on center in both directions.

2.04 PLASTIC LAMINATE MATERIALS AND ACCESSORIES

A. Plastic Laminate: NEMA LD 3; color as selected by Architect; textured, low gloss finish.
   1. Products: As scheduled.

B. Solid Laminate: As indicated color, and surface texture as selected.

C. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

D. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application; uncoated finish in concealed locations and stainless steel finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of SPF species.

B. Safety Glass: Fully Tempered glass complying with 16 CFR 1201 and ANSI Z97.1; clear; nominally 6 mm thick.

C. Primer: Alkyd primer sealer.

D. Wood Filler: Oil base, tinted to match surface finish color.

2.07 HARDWARE

A. Hardware: Comply with BHMA A156.9.

2.08 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Wood Preservative by Pressure Treatment (PT Type): AWPA Treatment C2 using water borne preservative with 0.25 percent retainage.

D. Water Repellent Preservative Treatment by Dipping Method: WDMA I.S. 4, with 0.25 percent retainage.

E. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

F. Provide identification on fire retardant treated material.

G. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

H. Redry wood after pressure treatment to maximum 6 percent moisture content.

2.09 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet and veneered material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Shop prepare and identify components for book match grain matching during site erection.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

G. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System best suited for application and expected performance.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.
   2. Opaque:
      a. System best suited for specified application and expected performance.
      b. Color: As selected by Architect.
      c. Sheen: Satin.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install trim and mouldings with brads or nails evenly spaced at not more than six inches on center.

E. Install prefinished paneling with full bed contact adhesive applied to substrate.

F. Install hardware in accordance with manufacturer's written instructions.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.05 SCHEDULE See Drawings

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. WI (CCP) - Certified Compliance Program (CCP); current edition at www.woodworkinstitute.com/certification.

H. WI (CSIP) - Certified Seismic Installation Program (CSIP); Current Edition.

I. WI (MCP) - Monitored Compliance Program (MCP); current edition at www.woodworkinstitute.com/certification.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   5. Replace, repair, or rework all work for which certification is refused.

1.07 MOCK-UPS

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet: Species and finish as indicated on drawings and in Finish Schedule.

C. Plastic Laminate Faced Cabinets: Custom grade. Laminate selections as indicated on Finish Schedule.

D. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Wood.
   2. Finish - Exposed Interior Surfaces: Wood.
   3. Finish - Semi-Exposed Surfaces: Decorative laminate
   4. Finish - Concealed Surfaces: Manufacturer's option.
   5. Door and Drawer Front Edge Profiles: as detailed.
   6. Door and Drawer Front Retention Profiles: Fixed panel.
   7. Casework Construction Type: Type B - Face-frame.
   8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
   9. Grained Face Layout for Cabinet and Door Fronts: Style and Rail, all Grades.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com
   2. Panolam Industries International, Inc: www.panolam.com
   3. Wilsonart LLC: www.wilsonart.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.04 COUNTERTOPS

A. See Section 12 3600.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome, satin chrome, or polished brass finish, as indicated for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: As indicated on drawings.

D. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc; Light-Duty Drawer Slides: www.accuride.com/#sle.
      b. Knape & Vogt Manufacturing Company; Light-Duty Drawer Slides: www.knapeandvogt.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
   1. Manufacturers:
      a. Hardware Resources: www.hardwareresources.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Finishing: Field finished, see Section 09 9300.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide center matched panels at each elevation.
   2. Provide sequence matching as indicated.
   3. Carry figure of cabinet fronts to toe kicks.

F. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

G. Provide cutouts for plumbing fixtures, inserts, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

H. Shop glaze glass materials using Interior Dry method; see Section 08 8000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.05 SCHEDULES SEE DRAWINGS

END OF SECTION 06 4100

SECTION 07 1113

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

B. Protection boards.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast in Place Concrete: Preparation of concrete surfaces to receive dampproofing.

B. 04 2000 - Unit Masonry Assemblies: Preparation of CMU surfaces to receive dampproofing. surfaces to receive

C. Section 31 2323 - Fill.

D. Section 33 4100 - Subdrainage.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

B. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).

C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

D. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013, with Editorial Revision (2019).

E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. BASF Corporation; Product Hydrocide 600

B. Other Acceptable Manufacturers:
   1. Karnak Corporation: Product Karnak #83AF Fibered Dampproofing : www.karnakcorp.com.
   2. Henry Company; Product 788 Non-Fibered Asphalt Emulsion Damp Proofing: www. henry.com.
   3. W.R. Meadows, Inc.; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.
   2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 1/8 inch, minimum, wet film.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.03 COLD ASPHALTIC MATERIALS

A. Basis of Design Product: Hydrocide 600, or 700B manufactured by BASF: www.basf.com.

B. Bitumen: Emulsified asphalt, ASTM D1227; with fiber reinforcement (Type I or II).
   1. Product: Karnak #83AF Fibered Dampproofing manufactured by Karnak Chemical Corp
   2. Product: SEALMASTIC™ EMULSION Type I manufactured by W.R. Meadows, Inc.

2.04 ACCESSORIES

A. Protection Board: 1/8-inch thick biodegradable hardboard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

D. Verify gaps in sheathing boards and all penetrations are properly taped or otherwise sealed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Site Walls: Apply two coats of dampproofing free from pin holes.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

E. Apply bitumen by spray, roller, or trowel application.

F. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal per coat.

G. Apply from 2 inches below finish grade elevation down to top of footings.

H. Seal items watertight with mastic, that project through dampproofing surface.

I. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

J. Scribe and cut boards around projections, penetrations, and interruptions.

3.04 INSTALLED LOCATIONS - SEE DRAWINGS

END OF SECTION 07 1113

SECTION 07 1300

SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-adhered modified bituminous sheet membrane.

B. Sheet membrane waterproofing for pre-(concrete) placement at horizontal, underslab applications including elevator, or other equipment pit structure(s), and underslab applications where indicated beneath occupied basement spaces.

C. Sheet membrane waterproofing for pre-placement at vertical blindside application to foundation walls where indicated, or where post (concrete) placement installation is infeasible.

D. Sheet membrane waterproofing for conventional post-placement below grade vertical applications.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrates.

B. Section 07 6200 - Sheet Metal Fabrications, Flashing and Trim: Metal parapet, coping, and counterflashing.

C. Section 22 1006 - Plumbing Piping Specialties: Coordination with plumbing penetrations.

D. Section 22 1005 - Plumbing Piping: Coordination with plumbing penetrations.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).

D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.

E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

F. ASTM D2581 - Standard Specification for Polybutylene (PB) Plastics Molding and Extrusion Materials; 2009.

G. ASTM D 3020 - Standard Specification for Polyethylene and Ethylene Copolymer Plastic Sheeting for Pond, Canal, and Reservoir Lining; 1989.

H. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane; 2009.

I. ASTM D4551 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane; 2012.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, and joint and crack sealants.

C. Shop Drawings: For each application with project specific details keyed to reference plan including termination conditions, transitions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Pre-Installation Conference: A Mandatory Pre-Installation Conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working condition and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashings. Those whose Attendance is mandatory is as follows:

1. General Contractor
2. Subcontractors' Full-time Superintendents / Field Supervisors – Shall also be fluent in English.
3. Architect
4. Building Envelope Consultant

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Construct mock-up consisting of 100 sq ft of horizontal and vertical sheet waterproofing panel; to represent finished work including internal and external corners, seam jointing, and attachment method.

C. Locate where directed.

D. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water.

D. For warranty repair work, remove and replace materials concealing waterproofing.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:
1. Location: as indicated on drawings.
2. Cover with protection board.

2.02 MANUFACTURERS

A. Pre Applied Waterproofing Membrane Systems - Basis of Design
1. Grace Construction Products] ; Product [Preprufe® 300R] for blindside applications to foundation walls.
2. Grace Construction Products] ; Product [Preprufe® 300R & 160R] for underslab, and blindside cast in place concrete applications.

B. Post Applied Waterproofing Membrane Systems - Basis of Design

1. Grace Construction Products; Product Bituthene® 3000 : www.grace .com for vertical below grade, cast in place concrete applications.
2. Grace Construction Products; Product Bituthene® 3000 : www.grace .com for vertical above grade, cast in place concrete applications.

C. Other Acceptable Manufacturers:
1. Carlisle Coatings & Waterproofing, Inc; Product MiraDri® 860/861: www.carlisle-ccw.com.
2. CETCO Building Materials; Product Envirosheet.
3. Henry® Company Product Blueskin® WP 200 self-adhering composite membrane
4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SHEET WATERPROOFING MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
1. Thickness: 60 mil, 0.060 inch, minimum.
2. Sheet Width: 36 inches, minimum.
3. Adhesives, Sealants, Termination Bars, Tapes, and Accessories: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03 INSTALLATION - SHEET MEMBRANE

A. Install each type (Post Applied) membrane waterproofing in accordance with manufacturer's individual instructions.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer. Roll out on substrate with a mechanical roller to encourage full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Coordinate with drain installation; see Section 22 1006.

H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

I. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 4 inches at subsequent plies laid in shingle fashion.

J. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.

B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

C. Adhere protection board to substrate with compatible adhesive.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. The Manufacturer’s Technical Representative shall perform site visits and provide written Field Reports issued within five (5) business days to the Subcontractor for prompt distribution to the Team.

C. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit backfilling or related activity against unprotected or uncovered membrane.

3.07 SCHEDULE SEE DRAWINGS

END OF SECTION 07 1300

SECTION 07 2100

THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, over roof deck, and exterior wall behind masonry veneer and precast concrete wall finish.

B. Batt insulation unfaced in interior and exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Concrete: Underslab moisture barrier

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
   1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
   2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
   3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2012.

G. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2014.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics and performance criteria.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermal Insulation:
   1. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com.
   2. DuPont™Nemours Thermax™.
   3. Johns Manville
   4. CertainTeed Corporation.

2.02 APPLICATIONS

A. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) board.

B. Insulation Over Sheathing & Metal Stud Framed Walls, Continuous: Extruded polystyrene (XPS) board.

C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

D. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.03 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 48 inch by 96 inch.
   4. Board Thickness: 1-1/2 inch.
   5. Board Edges: Square.
   6. Type and Compressive Resistance: Type II, 15 psi (104 kPa), minimum.

B. Extruded Polystyrene Board Insulation: (XPS) Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   2. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

C. Manufacturers (XPS):
   1. Dow® Building Systems; STYROFOAM® : www.dow.com/sle.
   2. Kingspan Insulation LLC; GreenGuard® Type IV XPS Insulation Board: www.trustgreenguard.com.
   3. Owens Corning® FOAMULAR® XPS: www.owenscorning.com.
   4. Substitutions: See Section 01 6000 - Product Requirements

D. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.

5. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Size: 48 inch by 96 inch.
7. Board Thickness: 1.5 inch, or as indicated.

E. Rigid Cellular Polyisocyanurate (ISO) Thermal Insulation Board with Facers Both Sides: Complying with ASTM C1289.
1. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
2. Board Size: 48 inch by 96 inch.
3. Board Thickness: 1.5 inch.
4. Products:
   a. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com/#sle.
   b. DuPont de Nemours, Inc; DuPont™ Thermax™: building.dupont.com/#sle.
   c. Johns Manville; AP Foil-Faced: www.jm.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.04 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

B. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
1. Material: Glass or mineral fiber.
2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
3. Formaldehyde Content: Zero.
4. Thermal Resistance: R -19 at wall cavities; R-30 at roof
5. Thickness: Full thickness in cavity space.
6. Facing: Unfaced.
7. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville: www.jm.com.
   c. Owens Corning Corporation: www.ocbuildingspec.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

A. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Provide foil facing on one side, at locations where required.
4. Thermal Resistance: R-value of 19.
5. Products:
   a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
   b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
   c. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
   d. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.
   e. Thermafiber, Inc; SAFB FF: www.thermafiber.com/#sle.
   f. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Flashing Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
1. Application: Sealing of interior circular penetrations, such as pipes or cables.
2. Width: Are required for application.
3. Temperature Resistance: Range of minus 40 to 212 degrees F.
4. Products:
   a. SIGA Cover Inc; SIGA-Rissan: www.siga.swiss/global_en/#sle.

b. Protecto Wrap Company; www.protectowrap.com/sle
c. Manufacturer's proprietary, or recommended tape Product.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Adhered Transition Flashing: Multipurpose, self-adhered flashing with modified butyl adhesive, polyester fiber top sheet, and polypropylene interlayer.
1. Application: Primerless adhesion for use as through-wall flashings and wall transitions to roof and below-grade systems.
2. Thickness: 45 mil, 0.045 inch, nominal.
3. Size: 6 inches wide, in rolls 75 feet long.

C. Unfaced batt Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

D. Support for Cladding and Continuous Insulation: Thermal clips.
1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing.
2. Galvanized Steel Support Clip: 14 gauge, 0.0747 inch, G90/Z275 galvanized support clip complying with ASTM A653/A653M, with integral glass fiber reinforced polyamide thermal isolator pad.
3. Stainless Steel Support Clip: 16 gauge, 0.0625 inch Type 304 stainless steel, with thermal isolator pad.
4. Clip Depth: As required for thickness of insulation.
5. Spacing of Clips: 16 inches on center, vertically.
6. Fasteners: As recommended by clip manufacturer.
7. Products:
a. Advanced Architectural Products, LLC; SMARTci GREENGirt Clips - Thermal Spacer series: www.smartcisystems.com/#sle.
b. Cascadia Windows & Doors; Cascadia Clip: www.cascadiawindows.com/#sle.
c. Northern Facades; ISO Clip: www.northernfacades.com/#sle.

E. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for metal wall panels.
2. Depth: As required for thickness of insulation.
3. Length: 6 inches for clips and 96 inches for girts.
4. Spacing: 16 inches on center, vertically.
5. Fasteners: As recommended by clip manufacturer.
6. Products:
a. Advanced Architectural Products, LLC; SMARTci GREENGirt System: www.smartcisystems.com/#sle.
b. Armatherm; Z Girt Structural Thermal Break: www.armatherm.com/#sle.
c. Cladiator; Slotted-Z FG: www.cladiator.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.

C. Install boards horizontally on walls.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

E. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.03 BOARD INSTALLATION AT CAVITY WALLS AND BATT INSULATION EXTERIOR FRMAED WALLS AND INTERIOR SOUND ATTENUATED WALLS

A. Secure insulation fasteners to substrate at following frequency:
   1. Six (6) per insulation board.

B. Install boards to fit snugly between wall ties.

C. Install boards horizontally on walls.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS

A. Install supports in accordance with manufacturer's installation instructions.

B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.

C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.

D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

3.06 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall, roof, and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Retain insulation batts in place with spindle fasteners at 12 inches on center.

3.07 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 2100

SECTION 07 2119

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls.
   2. In exterior wall crevices.
   3. At junctions of dissimilar wall and roof materials.
   4. In underside of roofs and ceilings.
   5. In underside of floor decks.
   6. In attics and crawlspaces.

B. Protective non-combustible coating.

C. Foamed-in-place insulation at exterior wall crevices requiring a thermal seal.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

B. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation; 2009.

C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

G. FM 4880 - Approval Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2015.

H. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers; 2017.

I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

J. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

K. UL 1040 - Standard for Safety Fire Test of Insulated Wall Construction; Current Edition, Including All Revisions.

L. UL 1715 - Standard for Safety Fire Test of Interior Finish Material; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

E. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

G. Certificates: Certify that products of this section meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke limitations.

1.07 MOCK-UPS

A. Provide an in-place mock-up, minimum 8 feet, or full height of wall high by 4 feet wide; include insulation overcoat, wall construction, window and frame, and door frame in mock-up.

B. Locate where directed.

C. Approved Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation: (Basis of Design)
   1. BASF Corporation; WALLTITE® LWP Series: www.spf.basf.com/#sle.
   2. Henry Company; PERMAX® 2.0X : www.henry.com/#sle.
   3. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
   4. CertainTeed Corporation Product CertaSpray® polyurethane foam.: www.certainteed.com
   5. Thermal Corporation of America ; Product THERMCO® Foam :www.thermco.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, semi-rigid, closed cell polyurethane foam; foamed on-site, using low GWP blowing agent of water and non-ozone-depleting gas.
   1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
      a. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
   2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
   3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended

thickness in accordance with ASTM E96/E96M, desiccant method.

4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
8. Manufacturers: See above

B. Insulation: ASTM C 1029, Type I, polyurethane.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: non-combustible coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
1. Coating Type: Single component, water-based.
2. Protected Insulation Type: Spray polyurethane foam (SPF).
3. Application: Apply using brush, roller, or airless sprayer.
4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
5. Exterior Wall System: Comply with NFPA 285.

C. Protective Coating: Cementitious type, spray applied; flame spread index (FSI) of 0 and smoke developed index (SDI) of 0, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to achieve a thermal resistance R-value of the adjacent insulation unless noted otherwise.

D. Apply protective coating monolithically, without voids, to fully cover foam insulation, to achieve fire rating required.

E. Patch damaged areas.

F. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

G. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Field inspections and tests will be performed by an independent testing agency.

C. Inspection will include verification of insulation and protective coating thickness and density.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

3.06 SCHEDULES SEE DRAWINGS

END OF SECTION

SECTION 07 2500

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive, Vapor Permeable Membrane, (Air Barrier): Installed under exterior wall cladding, over sheathing or other acceptable substrate.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-In-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

C. Section 07 5400 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

E. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

F. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier over exterior Sheathing.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that provide water and air-resistive barriers and are vapor retardant.

B. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm, or less.

C. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture-resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. AATCC Test Method 30 - Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials; 2004.

C. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2008.

D. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2012.

E. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a.

F. ASTM D779 - Standard Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method; 2003.

G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2011.

H. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2010.

I. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2009.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

L. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

M. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2011.

N. ASTM E2357 - 11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

O. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc.; 2009.

P. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc.; 2009.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, limitations, and statement of compatibility of all materials and products comprising the weather barrier system..

C. Shop Drawings: Provide drawings, including key plans and annotated elevations. Include details at a sufficiently large scale to clearly illustrate application of materials at all joint conditions, penetrations, transitions and terminations.

D. Manufacturer's Installation Instructions: Indicate surface preparation, installation methods, and storage and handling criteria.

E. Warranty: Submit manufacturer "Intent to Warrant Statement" including compatibility of products to be installed with completed Warranty forms completed in Owner's name and registered with manufacturer.

F. See Part 3.05 paragraph B for Closeout related documentation.

1.06 QUALITY ASSURANCE

A. Manufacturer shall provide a technical field representative to visit the Site no less than 1 day per week during the process of installation, but at critical milestones of the work, for the expressed purpose of observing the installation, inspection of the work in place and report on the progress , quality and acceptability of the work

B. Weather Barrier Manufacturer Qualifications: Company specializing in fluid applied, water and air resistive barrier membranes with 10 years experience in the manufacturing of systems specified for this work .

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 10 years experience and trained or certified by the manufacturer of the weather barrier system.

D. Pre-installation Meeting: Convene at least one week prior to beginning the work of this section, but not before all submittal requirements are met and comprehensive mock up has been constructed and approved. Prepare meeting notes and distribute to all attendees.
   1. Attendance is required for Representatives of:
      a. General Contractor
      b. Weather Barrier Installer
      c. Weather Barrier System Manufacturer Technical Field Representative.
      d. Exterior Sheathing subcontractor
      e. Masonry subcontractor
      f. Glass / Glazing subcontractor (Windows and Storefront, Curtainwall if different firms).
      g. Plumbing subcontractor
      h. Owner / Architect / Building Envelope Consultant

E. Warranty: Manufacturer: Ten year material warranty when installed under stucco veneer. Five year material warranty when installed elsewhere. Warranty for the weather barrier installed behind stucco shall be a system warranty offered jointly, from the face of sheathing out, with the Portland cement plaster manufacturer.

F. Warranty: Installer: Two year workmanship warranty against leakage and material failure due to installation.

1.07 MOCK-UP

A. Install air barrier and vapor retarder materials as part of comprehensive mock-up specified in Section 01400 Quality Requirements and as indicated on drawings.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

B. Do not install materials when temperature is below 40 degrees F (4 degrees C) or above 105 degrees F (41 degrees C).

C. Do not install materials if rain is imminent, or is forecast within 24 hours after application.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Coating: Cold-fluid-applied, vapor permeable, elastomeric waterproofing membrane.
   1. Material: Water-based Silyl -Terminated-Poly-Ether (STPE), Silyl -Terminated-Poly-Ester (STPEster), or acrylic 98% solids, with VOC content of zero.
   2. Acceptable Substrates: Stated by manufacturer as suitable for installation on concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
   3. Adhesion to Paper and Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.
   4. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 4 months weather exposure.
   5. Compatibility: Compatible with rubberized asphalt self adhering sheet material
   6. Air Permeance: 0.004 cubic feet per square foot (0.02 liters per second per square meter), maximum, when tested in accordance with ASTM E2178.
   7. Water Vapor Permeance: 12 perms (689 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
   8. Dry Film Thickness: 20 - 25 mils (0.020 - 0.025 inch) (.5-.55 mm), minimum.
   9. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
   10. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   11. Nail Sealability: Comply with requirements of ASTM D1970.
   12. Code Acceptance: Comply with applicable requirements of ICC-ES Acceptance Criteria AC 212.
   13. Tested and Passed ASTM E 2178 and ASTM E2357

B. Products: Basis of Design
   1. PROSOCO, Inc.Product PROSOCO R-GUARD® MVP: www.prosoco.com
      a. Flashing Accessory Material: PROSOCO R-GUARD® FastFlash; Fiberglass reinforced liquid applied membrane flashing complying with ASTM D1970,
         1) Composition: Any material that meets physical requirements of ASTM D1970 with exceptions indicated.
         2) Thickness: 40 mil (0.040 inch) (1.02 mm), nominal.
         3) Width: 8 inch minimum width for flashed openings

C. Other Acceptable Manufacturers / Products
   1. Carlisle Coatings & Waterproofing, Inc. Product ; Barritech VP®: www.carlisle-ccw.com.
      a. Flashing Accessory Material Product; LiquiFiber™W
   2. Grace Construction Products; Perm-A-Barrier® VP**:** www.na.graceconstruction.com.
      a. Flashing Accessory Material Product; Perm-A-Barrier® Liquid Membrane
   3. Henry® Company Air-Bloc® All Weather STPE
      a. Flashing Accessory Material Product; Air-Bloc® LF Liquid-Applied Flashing

4. Tremco® Global Sealants; ExoAir® 230 Fluid-Applied Vapor-Permeable Air Barrier Membrane : www.tremcosealants.com.
5. Flashing Accessory Material Product; ExoAir® 230 membrane with Tremco® 2011 Mesh**.**
6. BASF Corporation: ENERSHIELD. www.wallsystems.basf.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLICATIONS

A. Outside Surface of exterior sheathing: Sprayed coating.

B. Outside Surface of Inside Wythe of Exterior Masonry Cavity Walls: Sprayed coating.

C. Outside surface of CMU behind stacked stone masonry: Sprayed coating.

D. Other surfaces as indicated.

2.03 SEALANTS

A. Basis of Design: PROSOCO R-GUARD® Joint & Seam Filler

B. Other Acceptable Material
1. Silicone: Type Dow Corning® 795, or type as recommended by Weather Barrier Manufacturer and compatible with flashing and weather Barrier materials.

C. Silyl-terminated Polyether Sealant: Type BASF® MasterSeal NP 150 , (formerly Sonolastic® 150 VLM) or as recommended by Weather Barrier Manufacturer and compatible with flashing and weather barrier material

D. Sealant Backers: As specified in Section 07 9200.

E. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

2.04 ADHESIVES

A. Adhesive: Compatible with sheet seal and substrate, thick mastic of uniform consistency and furnished [By same manufacturer as part of a complete weatherproofing system.] .

2.05 ACCESSORIES

A. Flashing: Fiberglass reinforced fluid applied flashing complying with ASTM D1970, except slip resistance requirement is waived if not installed on a roof.
1. Basis of Design: PROSOCO R-GUARD® FastFlash
2. Composition: Any material that meets physical requirements of ASTM D1970 with exceptions indicated.

B. Self-Adhesive Sheet Flashing: ASTM D 1970.
1. By coating manufacturer as part of a complete weatherproofing system, or as recommended by coating manufacturer.

C. Primer:
1. By coating manufacturer as part of a complete weatherproofing system.

D. Termination Bars: Lip type, type 304 Stainless Steel bars, 1 inch (25 mm) x 10 feet (3000 mm) length each piece, 0.075 inches (1.905 mm) in thickness minimum; with anchors of same material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 PREINSTALLATION MEETING

A. See 1.06, D

3.04 INSTALLATION

A. Install materials in accordance with manufacturer's instructions and as follows

B. Coatings:
   1. Prepare substrate in manner recommended by coating manufacturer; fill and tape joints in sheathing substrate and between dissimilar materials.
   2. Repair and seal cracks, holes and penetrations
   3. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
   4. Primer or adhesive (if required): Install by spray or roller to minimum thickness of 1/4 inch (6 mm); use sheet seal to join to adjacent construction, seal airtight with sealant.
   5. Use flashing to seal to adjacent construction and to bridge joints.
   6. Sprayed Coating: Install to thickness recommended by manufacturer, but no less than 40 mils (1.5mm) dry film thickness.
   7. Use self-adhesive sheet flashing to seal to adjacent construction and to bridge joints.

C. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 9 inches (229 mm) beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.05 FIELD QUALITY CONTROL

A. Manufacturer shall provide a technical field representative to visit the Site no less than 1 day per week, but at critical milestones of the work, for the expressed purpose of observing the installation, inspection of the work in place and report on the progress , quality and acceptability of the work

B. Manufacturer Technical Field Representative shall perform a final inspection and upon acceptance of the work shall file a final report certifying that the work has been installed in compliance with the Manufacturer's recommendations and the requirements of the Project Specifications.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of the installation prior to covering up.

3.06 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

3.07 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Install air and vapor seal materials and assemblies in conjunction with materials described in other sections to provide continuous sealed barrier in the exterior enclosure of the building.

C. Sprayed Coating: Fill large joints; tape joints in substrate and between dissimilar materials; install sprayed coating over entire exterior surface; seal to adjacent construction with compatible sheet.

D. Exterior Masonry Veneer: Install masonry anchors before installing air/vapor retarder; seal around anchors airtight.

E. At junction of exterior wall and roof join wall seal to roof deck and seal.

F. At window, door, and operable louver openings install sheet seal between frame and adjacent wall seal material and attach with adhesive, or termination bar. Seal laps with sealant. Position lap seal over firm bearing.

G. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

END OF SECTION 07 2500

SECTION 07 4113

METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed, factory finished metal panels.

B. Attachment system.

C. Composite nail base insulated roof sheathing.

D. Waterproof underlayment

E. Accessories.

F. Metal Panel Soffit

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Roof framing and purlins.

B. Section 07 9200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

G. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2012).

J. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2011).

K. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 2011.

L. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.

3. Installation methods.
4. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
1. Show work to be field-fabricated or field-assembled.
2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
1. Include typical panel joint in sample.
2. Include typical fastening detail.

F. Test Reports: Indicate compliance of metal roofing system to specified requirements.

G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section, but not before construction and approval of samples and required submittal information.

1. Require attendance by the installer and relevant sub-contractors.
2. Include ACM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
4. Review procedures for protection of work and other construction.
5. Review safety precautions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide a mock-up for evaluation of fabrication workmanship.

C. Locate where directed.

D. Provide specified finish on panels.

E. Mock-up may remain not as part of the work, but as the minimum acceptable level of Quality and Workmanship for this Part of the Work.

F. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty (20) years from Date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels Manufacturer Basis of Design:

1. Petersen Aluminum Corporation: www.pac-clad.com.

B. Other Acceptable Manufacturers:

1. ATAS International, Inc: www.atas.com.
2. Berridge Manufacturing Company: www.berridge.com
3. McElroy Metal: www.mcelroymetal.com

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Steel Panels:
   a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M AZ50 coating.
   b. Steel Thickness: Minimum 22 gage (0.022 inch).
2. Profile: Standing seam, with minimum 1-3/4” inch seam height; concealed fastener system for field seaming with special tool.
3. Texture: Smooth.
4. Length: Full length of roof slope, without lapped horizontal joints.
5. Width: Maximum panel coverage of 16 inches, or as shown on Drawings.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gage steel framing incidental to structural supports; fabricated from steel sheet.

B. Framing Material: ASTM A 1011/A 1011M, Designation SS steel sheet.

1. Profile: Manufacturer's standard cee, plain channel, and angle.

2. Thickness: 12 gage, 0.1046 inch.
3. Finish: Galvanized per ASTM A653/A653M, G90.

C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.

D. Panels: Provide factory or field fabricated panels with factory applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

E. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
1. Exposed Sealant: Neutral Cure Silicone.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970; 40 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
2. Self Sealability: Passing nail sealability test specified in ASTM D1970.
3. Low Temperature Flexibility: Passing test specified in ASTM D1970.
4. Water Vapor Permeance: 0.067 perm, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
5. Liquid Water Transmission: Passes ASTM D4869.
6. Functional Temperature Range: Minus 70 degrees F to 260 degrees F.
7. Products:
a. Grace Construction Products®; Product Grace Ice & Water Shield® HT.:www.graceconstruction.com
b. Henry® Company; Product Blueskin® PE 200 HT High Temperature Roof Underlayment.: www.henrycompany.com
c. Polyguard® Products, Inc.; Product Deck Guard® HT.:
d. Substitutions: See Section 01 6000 - Product Requirements.

2.07 FINISHES

A. Factory Finish: multiple coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 1.20 mil, total minimum thickness - 2 coat system.

1. Products:
a. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
b. Sherwin-Williams Coil Coatings; Fluropon: www.coil.sherwin.com/#sle.
c. ARKEMA, Inc.; Kynar Aquatec® / Kynar 500® : www.arkema.com/usa.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Color/Texture: As selected by Architect from Coating manufacturer's full range of available choices, including metallics.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Install roofing system with exposed fasteners prefinished to match panels.
   3. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Underlayment where indicated: Install waterproof underlayment and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in slip sheet and seams in waterproof underlayment.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Incorporate concealed clips at panel joints, and apply snap-on battens to provide weathertight joints.
   3. Provide sealant tape or other approved joint sealer at lapped panel joints.
   4. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 4113

SECTION 07 4213.23

METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed aluminum composite material (ACM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing, trim, and accessories.

C. Exterior cladding consisting of perforated, formed aluminum composite material (ACM) sheet, secondary supports, and anchors to aluminum curtain wall assembly.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Installation of anchors.

B. Section 04 2000 - Unit Masonry Assemblies: Installation of anchors.

C. Section 05 4000 - Cold-Formed Metal Framing: Panel support framing.

D. Section 06 100 - Rough Carpentry : Plywood Sheathing Substrate at specific locations, see Drawings.

E. Section 07 2500 - Weather Barriers: Water-resistive barrier behind wall panel system.

F. Section 07 6200 - Sheet Metal Fabrications, Flashing and Trim: Metal flashing components integrated with this wall system.

G. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

H. Section 08 4413 - Glazed Aluminum Curtain Wall.

I. Section 09 2116 - Gypsum Board Assemblies: Sheathing backup of composite panels.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

G. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

H. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2015.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

K. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

L. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

O. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

P. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).

Q. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2014.

R. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 2010.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

T. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

U. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

V. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

W. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section, but not before construction and approval of samples and required submittal information.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include ACM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.
   5. Review safety precautions.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data - ACM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

E. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's full range of available colors and patterns.
   1. Sealant Color: Color to match wall panels.

F. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.

G. Certificate: Certify that the work results of this section meet or exceed specified requirements.

H. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

I. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

J. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

K. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

L. Designer's qualification statement.

M. Manufacturer's qualification statement.

N. Installer's qualification statement.

O. Testing agency's qualification statement.

P. Maintenance Data: Care of finishes and warranty requirements.

Q. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

R. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.06 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in Alabama.

C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
   1. With not less than three years of documented experience.
   2. Approved by ACM sheet manufacturer.
   3. Submit contact names and phone numbers for at least three references connected with successful past projects.

D. Installer Qualifications: Company specializing in performing work of type specified in this section.
   1. With minimum three years of documented experience.

2. Approved by wall panel system manufacturer.
3. Submit contact names and phone numbers for at least three references connected with successful past projects.

E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide a mock-up for evaluation of fabrication workmanship.

C. Locate where directed.

D. Provide specified finish on panels.

E. Mock-up may remain not as part of the work, but as the minimum acceptable level of Quality and Workmanship for this Part of the Work.

F. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
1. Protect finishes by applying heavy-duty removable plastic film during production.
2. Package for protection against transportation damage.
3. Provide markings to identify components consistently with drawings.
4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

C. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in well-ventilated space out of direct sunlight.
2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
3. Store at a slope to ensure positive drainage of accumulated water.
4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.09 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five (5) years from Date of Substantial Completion.

C. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

D. MCM System Warranty: Fabricator's standard form in which manufacturer agrees to repair or replace components of MCM systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Composite Material Sheet Manufacturers: Basis of Design:
1. 3A Composites USA; ALUCOBOND®: www.alucobondusa.com

B. Aluminum Composite Material Sheet Manufacturers: Other Acceptable Manufacturers:
1. Arconic, Inc; Reynobond® Aluminum Composite Material – 160FR: www.arconic.com
2. ALPOLIC Materials; ALPOLIC / fr (fire resistant core): www.alpolic-usa.com.
3. Alucoil North America LLC; Larson by Alucoil, FR Core (fire resistant): www.alucoilnorthamerica.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 METAL COMPOSITE WALL PANEL SYSTEM FABRICATORS

A. MCM Wall Panel Systems fabricators:

1. Abrams Architectural Products, Inc.: www.abramssales.com
2. FLC Systems; ACM Panel Systems: www.flcsystems.com
3. Kistler McDougall; Series 400: www.kmcorpusa.com.
4. Miller Clapperton; MCM 1500. www.millerclapperton.com
5. National Panel Systems; ACM Panel Systems: www.nationalpanelsystems.com
6. Southern Aluminum Finishing C-4000: www.saf.com
7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing provided by the panel system supplier as component of a complete system, or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
1. Provide structural design by or under direct supervision of a Structural Engineer licensed in Alabama.
2. Provide panel jointing and weather seal using reveal joints / drain-back ventilated rainscreen system as indicated.
3. Anchor panels to supporting framing without exposed fasteners.

2.04 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

B. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
1. Wall systems and attachments are to resist the wind loads as determined by local building code in pounds per square foot.
2. Design Wind Pressure: In accordance with local building code and as indicated on drawings.

3. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
4. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

C. Air Leakage: 0.10 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

D. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf minimum, after 15 minutes.
1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
2. Design to drain leakage and condensation to the exterior face of the wall.

E. Fire Performance: Use test method complying with NFPA 285.

2.05 PANELS

A. Typical System Panel Depth: 2 inches.

B. Panels: 1 inch deep pans formed of aluminum composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Reinforce corners with riveted aluminum angles.
2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
4. Reinforce panels over 96 inches long with metal angle braces 24 inches on center in short direction.
5. Secure members to back face of panels using structural silicone sealant approved by ACM sheet manufacturer.
6. Fabricate panels under controlled shop conditions.
7. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
8. Fabricate as indicated on drawings and as recommended by ACM sheet manufacturer.
   a. Make panel lines, breaks, curves, and angles sharp and true.
   b. Keep plane surfaces free from warp or buckle.
   c. Keep panel surfaces free of scratches or marks caused during fabrication.
9. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
10. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

C. Perforated Panels: 1 inch deep pans formed of perforated aluminum composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Perforations: 40% open, perforated 1/8" hole with 3/16" spacing.
2. Reinforce corners with riveted aluminum angles.
3. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
4. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
5. Secure members to back face of panels using structural silicone sealant approved by ACM sheet manufacturer.
6. Fabricate panels under controlled shop conditions.

7. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
8. Fabricate as indicated on drawings and as recommended by ACM sheet manufacturer.
    a. Make panel lines, breaks, curves, and angles sharp and true.
    b. Keep plane surfaces free from warp or buckle.
    c. Keep panel surfaces free of scratches or marks caused during fabrication.

2.06 MATERIALS

A. Aluminum composite material (ACM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
    1. Overall Sheet Thickness: (0.157 inch, minimum.
    2. Face Sheet Thickness: 0.019 inch, minimum.
    3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
    4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
    5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    6. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, 2 piece adjustable zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
    1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
    2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
    3. Stainless Steel Sheet Components: ASTM A480/A480M.
    4. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.07 FINISHES

A. Factory Finish: multiple coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 1.20 mil, total minimum thickness - 2 coat system.
    1. Products:
        a. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
        b. Sherwin-Williams Coil Coatings; Fluropon: www.coil.sherwin.com/#sle.
        c. ARKEMA, Inc.; Kynar Aquatec® / Kynar 500® : www.arkema.com/usa.
        d. Substitutions: See Section 01 6000 - Product Requirements.

C. Color/Texture:
    1. As selected by Architect from Coating manufacturer's full range of available choices, including metallics.
    2. Custom Color/Texture: Custom colors to match Architect’s samples; manufacturer’s standard texture.

2.08 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match ACM sheet; see Section 07 6200 for additional requirements.

B. Mounting Brackets Basis of Design: Panel Manufacturer's proprietary, or recommended, Thermally-broken,6063, T6 marine grade aluminum, Type 304 Stainless Steel, adjustable Zee Girts for attachment to building structure.
   1. ECO CLADDING, Alpha Vci or Alpha Hci Systems as determined by panel layout and slab edge conditions.

C. Other Acceptable Manufacturers Products:
   1. CLADIATOR® CL 300 thermally isolated, adjustable cladding support® System Cladding Attachment: www.knightwallsystems.com.
   2. SMART Ci ® Systems BY A2P Product GreenGirt Delta® Adjustable System : www.smartcisystems.com

D. Anchors, Clips, and Accessories: Use one of the following:
   1. 6063 Alloy, T6 Temper Marine Grade Aluminum
   2. Type 304 Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   3. Steel complying with ASTM A36/A36M and hot-dip zinc coating to ASTM A153/A153M.
   4. Pultruded Fiberglass & galvanized steel / hybrid.

E. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   3. Bolts: Stainless steel.
   4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

F. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15-mil dry film thickness per coat.

G. Joint Sealant: Provide color to match wall panels silicone sealant of type approved by ACM sheet manufacturer, and in compliance with ASTM C920.
   1. See Section 07 9200 for additional requirements.

H. Provide panel system manufacturer's and installer92s standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.
   1. Verify that weather barrier system is properly installed; see Section 07 2500 for requirements.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Provide anchorage items to be cast into concrete or built into masonry to appropriate installer(s) together with setting templates.

1. See Section 03 3000 for additional cast-in-place concrete requirements.
2. See Section 04 2000 for additional unit masonry requirements.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of ACM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with ACM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Where joints are designed for field-applied sealant, seal joints completely with specified sealant.

H. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

J. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when completed repars are recorded and approved in writing by the Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Wall System Manufacturer's Field Representative: Provide technical field services representative of wall system Manufacturer to perform periodic inspections of the Work in progress in accordance with instructions and as follows:
   1. Pre-installation meeting at which time substrate and weather barrier shall be installed for approval.
   2. Completion of sub frame, prior to panel installation.
   3. Panel installation @ 25%, 60% and final inspection.

C. Wall System Manufacturer's Field Representative shall produce field observation report and photos at every site visit.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION 07 4213.23

SECTION 07 5400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Cover Board.

D. Parapet Sheathing

E. Limited Flashing work.

F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. 00 6330 - General Contractor's Roofing Guarantee

B. Section 07 7100 - Roof Specialties: Prefabricated copings and fasciae..

C. Section 07 7600 - Roof Pavers: Roof mounted pavers and pedestals.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2012.

F. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board; 2013.

G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

I. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2012.

J. ASTM D6754/D6754M - Standard Specification for Ketone Ethylene Ester Based Sheet Roofing; 2015.

K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

L. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.

M. FM DS 1-28 - Wind Design; 2007.

N. ITS (DIR) - Directory of Listed Products; current edition.

O. NRCA (RM) - The NRCA Roofing Manual; 2018.

P. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

Q. UL (DIR) - Online Certifications Directory; Current Edition.

R. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Indicate deck penetrations, joint or termination detail conditions, conditions of interface with other materials,

D. Include fastening diagram(s) and information regarding material edge conditions per ASCE 7.

E. **Manufacturer's standard details, or other standard details such as from the NRCA shall not be acceptable as shop drawings. Shop drawings shall reflect the specific construction of this project as based on verification of actual as built conditions in the field which should, but may not exactly follow the Contract Drawings.**

F. Shop Drawings: Submit drawings that indicate joint or termination detail conditions and conditions of interface with other materials.

G. Samples for Verification: Submit two assembled samples 12 by 12 inches in size illustrating insulation and membrane attachment.

H. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, perimeter conditions requiring special attention, and counter flashing sequencing.

I. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

J. Installer's qualification statement.

K. Warranty: Reference paragraph 1.08.

L. Warranty: Submit manufacturer Intent to Warrant Statement as outlined herein, Statement of Compatibility of Products comprising system, including accessories and edge metal components. Ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Pre-installation Meeting: Convene at least one week prior to beginning the work of this section, but not before all submittal requirements are met and mock up is approved.

B. Meeting shall also not convene before roof deck is in place, all penetrations and curbs have been installed and substrate is ready to receive deck sheathing.

C. Attendance required for Representatives of:
   1. General Contractor
   2. Roofing subcontractor
   3. Roofing subcontractor’s Full-time Superintendent
   4. Roofing Manufacturer Technical Field Representative.
   5. Mechanical Systems subcontractor
   6. Owner / Architect / Building Envelope Consultant

D. Company specializing in manufacturing the products specified in this section with minimum 15 years documented experience using the exact membrane, with unchanged chemical formulation, proposed for use on the project.

E. Installer Qualifications: Company specializing in performing the work of this section:
   1. With minimum 20 years documented experience.
   2. Approved by membrane manufacturer.

F. See Paragraph 3.06 for requirements of Roofing Manufacturer Technical Field Representative inspection and reporting obligations.

G. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 12 years of Documented experience utilizing single ply roof sheet material consistent

with the type, chemical formulation and method(s) of fabrication and installation referenced herein. experience.

H. Installer Qualifications: Company specializing in performing work of this section with at least 15 years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Store products according to manufacturer's instructions to avoid damage or deformation of membrane or accessories.

E. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 105 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. WARRANTY
   1. Reference Document 00 6330 - General Contractor's Roofing Guarantee for additional warranty requirements.
   2. Reference UA Design & Construction Guidelines for Low Slope Roofing Assemblies- for Special warranty requirements.
   3. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   4. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 20 years after installation.
   5. Edge to Edge System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing and associated components that leak or are damaged due to wind or other natural causes and as follows:.
      a. Wind less than 165 mph, based on 3 second gust as defined by ASCE-7
      b. Hail Rating: FM 4470 Severe Hail (SH) rating
      c. Warranty Term: 30 years Roof Assembly as designed with a documented maintenance record after 20 years.
         1) For repair and replacement include costs of both material and labor in warranty.
   6. Exceptions NOT Permitted:
      a. Damage due to roof traffic.
      b. Damage due to wind of speed greater than 72 mph but less than 110 mph.

B. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Modified PVC Membrane Materials: Basis of Design
   1. Seaman Corporation; FiberTite® 50-XT Roofing Membrane: www.fibertite.com.

B. Other Acceptable Manufacturers Subject to Approval of the Owner:
   1. DuroLast Corporation: Durolast EV/PVC60
   2. Johns Manville Corporation : JM 60 mil PVC with DuPont Elvaloy® KEE : www.jm.com.
   3. Siplast®: 60 mil PARASOLO® PVC KEE
   4. Carlisle SynTec Systems: Sure-Flex™ 60-mil PVC/KEE: www.carlislesyntec.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Insulation: Basis of Design
   1. Seaman Corporation Fibertite FTR Value, Polyiso rigid insulation : www.fibertite.com

D. Other Acceptable Manufacturers Subject to Approval of the Owner:
   1. Dur O Last Polyiso Roof Insulation: www.gaf.com.
   2. Dow Chemical Co: Styrofoam™ Brand Deckmate™ Plus FA Insulationwww.dow.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: Single ply membrane, fully adhered, over vapor retarder and insulation over cover board and insulation .

B. Roofing Assembly Requirements: cover board
   1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
      a. Calculate SRI in accordance with ASTM E1980.
      b. Field applied coating may not be used to achieve specified SRI.
   2. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. Material: Modified Polyvinyl Chloride acrylonitrile butadiene polymer or ketone ethylene ester (KEE) complying with ASTM D 4434 (PVC), ASTM D 6764 (KEE).
   2. Reinforcing: Fabric backing.
   3. Thickness 0.050 inch (50mil), minimum. (KEE membrane)
   4. Sheet Width: Factory fabricated into largest sheets possible.
   5. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
   6. Thermal Emissivity: 0.80, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
   7. Color: To be selected by Architect from manufacturer's full color range.
   8. Solar reflectance index (SRI): 107.
   9. Acceptable Products: See 2.01.
   10. KEE: Ketone ethylene ester (KEE) complying with ASTM D6754/D6754M, sheet reinforced with fabric.
      a. Basis of Design Thickness: 50 mil, 0.050 inch, minimum (other acceptable mfr. 60 mil minimum)

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

D. Through-Wall Flashing with Termination Bar: At least 45 mil, 0.045 inch thick poly-reinforced membrane with extruded termination bar and drip-edge.
   1. Width: 18 inches, minimum.
   2. Products: As provided, or recommended / approved by membrane manufacturer.

2.04 COVER BOARD AND PARAPET SHEATHING

A. Basis of Design Product: Parapet substrate: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch thick.
   1. DensDeck® Prime Roof Board manufactured by Georgia Pacific Corporation

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch thick.
   1. Products:
      a. Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com/#sle.
      b. USG Corporation; Securock Ultralight Coated Glass-Mat Roof Board: www.usg.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Termination Bars and pressure bars: Lip type, type 304 Stainless Steel bars, 1 inch (25 mm) x 10 feet (3000 mm) length each piece, 0.075 inches (1.905 mm) in thickness minimum; with anchors of same material.

C. Membrane Adhesive: Low VOC as recommended by membrane manufacturer.

D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

F. Strip Reglet Devices: stainless steel, maximum possible lengths per location, with attachment flanges.

G. Insulation Perimeter Restraint: Stainless steel edge device configured to restrain insulation boards in position.

H. Sealants: As recommended by membrane manufacturer.

I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.
   2. Surface Color: As selected..

J. Coverboard and sheathing Joint Tape: Heat resistant, elastomeric type, 2 inches wide, self adhering.

K. Sheathing and coverboard fasteners: Appropriate for purpose intended and approved by Factory Mutual and roofing manufacturer.

L. Membrane Adhesive: Solvent-based as recommended by membrane manufacturer.

M. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

N. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify substrate is adequately cleaned, secure ready to receive primer if required.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof assembly.

D. Verify deck surfaces are adequately dry and free of snow or ice.

3.02 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or inclement weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.03 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate of the manufacturer’s recommended rate, but no less than 2 gal/square Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by heat welding, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane up a minimum of 8 inches onto vertical surfaces secure with pressure bar fastened 8 inches on center.
   2. Fully adhere flexible flashing over membrane and up to nailing strips on top of parapet.
   3. Secure flashing to nailing strips at 4 inches on center.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing in accordance with requirements.

C. Require site attendance of roofing and insulation material manufacturers as follows: Preinstallation Conference, weekly during installation of the Work, or as required to inspect the work prior to concealment and once to conduct a final inspection.
   1. Preparation and filing of Field report and photo documentation at each visit is required as a condition on ensuring proper installation.
   2. Final Report / Statement of acceptance to be submitted as part of Closeout Documents

D. Require site attendance of roofing and insulation material manufacturers to perform a minimum of three site observations during installation of the Work: First, to observe the application of the insulation, Second to observe the installation of the membrane and flashings and Third to observe the installation of the coping system. A final inspection and accompanying Report of acceptance shall be required prior to any Owner acceptance an commencement of Warranty Period..

3.05 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove overspray, or mastic drips from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions prior to cleaning..

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials without sharp edges, or protrusions which may damage roof membrane

END OF SECTION 07 5400

SECTION 07 6200

SHEET METAL FABRICATIONS, FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and other items indicated.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and blocking.

B. Section 07 4113 - Metal Roof Panel System.

C. Section 07 4213.23 - Metal Composite Material Wall Panels.

D. Section 07 5400 - Thermoplastic Membrane Roofing: Flashings associated with Single Ply Roofing system.

E. Section 07 7100 - Roof Specialties: Preformed flashings and manufactured expansion joint covers.

F. Section 07 7123 - Manufactured Gutters and Downspouts.

G. Section 07 7200 - Roof Accessories: Roof-mounted equipment curbs, roof hatches.

H. Section 07 9200 - Joint Sealers.

I. Section 09 9000 - Painting and Coating: Field touch up painting of factory finished items.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

H. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction; 2012.

I. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.

J. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2014.

K. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2013a.

L. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

M. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

N. CDA A4050 - Copper in Architecture - Handbook; current edition.

O. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section, but not before construction and approval of samples and required submittal information.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details including interface with adjoining work and concealed supports.

C. Samples: Submit sufficient number of samples, 8 x 8 inch, or larger in size which illustrate material, finish, and fabrication details of typical external corner, internal corner, and junction to vertical dissimilar surface.

D. Samples for initial verification: Submit sufficient number of samples 6 x 6 inch in size, but no less than 2 x 2 inches illustrating manufacturer's full range of metal finish colors.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 20 years of documented experience.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide a mock-up for evaluation of fabrication workmanship.

C. Locate where directed.

D. Provide specified finish on panels.

E. Mock-up may remain not as part of the work, but as the minimum acceptable level of Quality and Workmanship for this Part of the Work.

F. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.022 inch thick base metal, shop pre-coated with superior performance PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Provide 20 year finish warranty against fading, chalking cracking or peeling

B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.040 inch thick; plain finish shop pre-coated with fluoropolymer coating.
1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.

C. Stainless Steel: ASTM A666, Type 304, soft temper, 0.0253 inch thick; smooth No. 4 finish.

2.02 FINISHES

A. Factory Finish: multiple coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 1.20 mil, total minimum thickness - 2 coat system.
1. Products:
a. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
b. Sherwin-Williams Coil Coatings; Fluropon: www.coil.sherwin.com/#sle.
c. ARKEMA, Inc.; Kynar Aquatec® / Kynar 500® : www.arkema.com/usa.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Color/Texture:
1. As selected by Architect from Coating manufacturer's full range of available choices, including metallics.
2. Custom Color/Texture: Custom colors to match Architect’s samples; manufacturer’s standard texture.

2.03 ACCESSORIES

A. Underlayment: Self adhering rubberized asphalt sheet, 40 mils minimum.

B. Sealant: Type silicone specified in Section 07 9005.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, minimum 12 inches wide, interlocking with sheet.

C. Form pieces in longest possible lengths, but no less than 8 feet.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Use of "pop rivets" is not permitted.

G. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE SEE DRAWINGS

END OF SECTION 07 6200

SECTION 07 7100

ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, gravel stops, and Edge Metal.

1.02 RELATED REQUIREMENTS

Section 07 7200 - Roof Accessories:

A. Section 07 9200 - Joint Sealants

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

E. NRCA (RM) - The NRCA Roofing Manual; 2019.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

G. ANSI/SPRI/FM 4435/ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized corner samples of coping and Fascia.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section, but not before construction and approval of samples and required submittal information.

1. Require attendance by the installer and relevant sub-contractors.
2. Include ACM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
4. Review procedures for protection of work and other construction.
5. Review safety precautions.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide a mock-up for evaluation of fabrication workmanship.

C. Locate where directed.

D. Provide specified finish on panels.

E. Mock-up may remain not as part of the work, but as the minimum acceptable level of Quality and Workmanship for this Part of the Work.

F. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Copings and Gravel Stops: Basis of Design

1. Coping: Peterson Aluminum Corp; Pac-Tite Gold; Pac-Tite, Tapered: www.pac-clad.com
2. Gravel Stop: Hickman: hickmanedgesystems.com

B. Other Acceptable Manufacturers:

1. Coping:
   a. Hickman; Product: PermaSnap Premier Plus: www.hickmanedgesystems.com
   b. ATAS International, Inc
   c. Substitutions: See Section 01 6000 - Product Requirements.
2. Gravel Stop:
   a. ATAS International, Inc: www.atas.com
   b. Metal-Era: www.metalera.com
   c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Gravel Stops: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Gravel Stop / Fascia and edge securement for roof membrane.
2. Pull-Off Resistance: Tested in accordance with SPRI ES-1 RE-1 and RE-2 to positive and negative design wind pressure as defined by SPRI ES-1 and the International Building Code 2021.
3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.
5. Color: To be selected by Architect from manufacturer’s full range of choices including metallics.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with SPRI ES-1 to positive and negative design wind pressure as defined by SPRI ES-1 and the International Building Code 2021.
3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.
5. Color: To be selected by Architect from manufacturer's full range of options including metallics.

2.01 ACCESSORIES

A. Sealant: Type [Silicone] as specified in Section 07 9200 Joint Sealants.

2.02 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

B. Color/Texture:

1. As selected by Architect from Coating manufacturer's full range of available choices, including metallics.

2. Custom Color/Texture: Custom colors to match Architect’s samples; manufacturer’s standard texture.

2.03 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

C. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.

1. Products:

a. OMG Roofing Products; OlyBond500: www.roofing.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

F. Coordinate installation of flashing flanges into reglets.

3.03 SCHEDULES SEE DRAWINGS

END OF SECTION

SECTION 07 7123

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.02 RELATED REQUIREMENTS

A. Section 07 4113 - Metal Roof Panels.

B. Section 07 6200 - Sheet Metal Fabrications, Flashing and Trim.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

I. ANSI/SPRI GT-1 – Test Standard for Gutter Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Comply with applicable code for size and method of rain water discharge.

C. Maintain one copy of each document on site.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details. Coordinate exact layout of downspouts with field location of downspout discharge pipe inlet.

C. Product Data: Provide data on prefabricated components.

D. Design Criteria: Gutters shall be manufactured in specified manufacturer’s facilities. Gutters fabricated by installer or other fabricator will not be acceptable unless fabricator can demonstrate to Architect’s satisfaction that Gutters have been tested for resistance in accordance with ANSI/SPRI GT-1.

E. Samples: Submit two samples, 12x12 inches square illustrating component design, finish, color, and configuration.

F. Exterior Material Color/Finish: Color and finish samples will be reviewed together with all exterior materials, and final approval will be provided with the full approved exterior wall assembly mockup.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:

1. Hickman: www.hickmanedgesystems.com
2. Peterson Aluminum Corp: www.pac-clad.com
3. ATAS International, Inc: www.atas.com
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M);.040 inch thick.
   1. Finish: Plain, shop finished with PVDF (polyvinylidene fluoride) coating.
   2. Color: As selected by Architect from manufacturer's full range of available choices including premium and metallics.

B. Protective Backing Paint: Zinc molybdate alkyd.

2.03 COMPONENTS

A. Gutters: Profile as indicated.

B. Conductor Heads: Profile and size as indicated.

C. Downspouts: Profile as indicated.

D. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with CDA requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers.

2.04 FABRICATION

A. Form gutters, conductor heads and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES

A. Fluoropolymer Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as selected by Architect from Coating manufacturer's full range of available choices, including metallics.

B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Locate downspouts in field to coordinate with locations shown on Elevation drawings and with field conditions for pipe discharge inlet location.

D. Provide concrete splash pads at locations where downspouts discharged onto adjacent roofing, or on grade.

E. Slope gutters 1/8" inch per foot .

F. Connect downspouts to storm sewer system. Seal connection watertight.

END OF SECTION

SECTION 07 7200

ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof curbs.

B. Roof penetrations mounting curbs.

C. Roof hatches.

1.02 RELATED REQUIREMENTS

B. Section 07550 - Modified Bituminous Roofing

C. Section 15671 - Air Cooled Condensing Units: Curbs supplied with Mechanical equipment.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.
   5. For smoke hatches, submit evidence of approval by evaluation agency specified.

C. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Manufacturers:
   1. AES Industries Inc: www.aescurb.com.
   2. The Pate Company: www.patecurbs.com.

B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
   2. Sheet Metal Material:
   3. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gauge, 0.048 inch thick.
   4. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches.

5. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
    a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
    b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
    c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
    d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
6. Provide layouts and configurations indicated on drawings.

C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
1. Provide preservative treated wood nailers along top of curb.
2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
3. Height Above Finished Roof Surface: 8 inches, minimum.
4. Height Above Roof Deck: 14 inches, minimum.

D. Equipment Rails: Steel wide flange sections as detailed in Structural drawings.
1. Provide preservative treated wood nailers along top of rails.
2. Height Above Roof Deck: 14 inches, minimum.

E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.
1. Provide sliding channel welded along top edge with adjustable height steel bracket, fabricated to fit item supported.
2. Height Above Finished Roof Surface: 8 inches, minimum.
3. Height Above Roof Deck: 14 inches, minimum.

2.02 ROOF HATCHES (MANUAL OPERATION)

A. Roof Hatch Manufacturers:
1. Bilco Co.: www.bilco.com
2. Dur-Red Products: www.dur-red.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.

C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Stainless steel, Type 304, 14 gauge, 0.0747 inch thick.
2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
3. Curb Height: 12 inches from finished surface of roof, minimum.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gauge, 0.0747 inch thick, liner 22 gauge, 0.03 inch thick.
3. Finish: Field painted with two finish coats with Direct-to-Metal (DTM) Paint as Manufactured by Tnemec, Sherwin Williams, or approved equal.
4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacture.
1. Hinges: Heavy duty pintle type.

F. Ladder Assist Post: Bilco Co. LadderUp® or approved equal Safety Post to meet current Safety Guidelines.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 07 7200

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

B. Section 07 8100 - Applied Fire Protection.

C. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. FM (AG) - FM Approval Guide; current edition.

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

F. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

G. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 MOCK-UPS

A. Install one firestopping assembly representative of each fire rating design required on project.

1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
2. Where firestopping is intended to fill a linear opening, install at least 1 linear foot of firestopping.

B. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.

C. If accepted, mock-up will represent minimum standard for this work.

D. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

C. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

2.04 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Manufacturers: Basis of Design
      a. A/DFire Protection Systems Inc; Product Fire Barrier Silicone: www.adfire.com.
      b. 3M Fire Protection Products; Product 3M Fire Barrier Silicone Sealant 1000 N/S, 1003 S/L: www.3m.com/firestop.
      c. Hilti, Inc; Product CP 601S Firestop Sealant: www.us.hilti.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
   1. Density: 4 lb/cu ft.
   2. Water Absorption: < 1%
   3. Air Permeability: 0 cfm/sq ft.
   4. Durability and Longevity: Permanent.
   5. Manufacturers:
      a. A/DFire Protection Systems Inc; Product Fire Barrier Mineral Wool: www.adfire.com.
      b. Thermafiber; Product Safing Insulation; www.thermafiber.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, collar, and / or galvanized steel collar, intended to be installed after penetrating item has been installed; conforming to the following:
   1. Durability and Longevity: Permanent .
   2. Manufacturers:

a. Grace Construction Products; Product FlameSafe Firestop Device: www.na.graceconstruction.com.
b. Hilti, Inc; Product CP 643N, CP 644: www.us.hilti.com.
c. Specified Technologies, Inc; Product SSC Series: www.stifirestop.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Firestop Devices - Cast-In Type: Sleeve and sealing material, intended to be cast in concrete floor forms or in concrete on metal deck, not requiring any additional materials to achieve penetration seal.
1. Durability and Longevity: Permanent.
2. Manufacturers: Basis of Design
a. Hilti, Inc; Product 680 Series: www.us.hilti.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

F. Intumescent Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
1. Potential Expansion: Minimum 1000 percent.
2. Durability and Longevity: Permanent.
3. Color: Black, dark gray, or red.
4. Manufacturers:
a. Grace Construction Products; Product FSP 1000: www.na.graceconstruction.com.
b. Hilti, Inc; Product CP 617, CP 618: www.us.hilti.com.
c. Specified Technologies, Inc; Product SpecSeal Series SSP: www.stifirestop.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

G. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration; conforming to the following:
1. Durability and Longevity: Permanent.
2. Manufacturers:
a. Grace Construction Products; Product FlameSafe Bags and Pillows: www.na.graceconstruction.com.
b. Specified Technologies, Inc; Product SpecSeal Series SSB Firestop Pillows: www.stifirestop.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

H. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 8400

SECTION 07 9200

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

D. Owner-provided field quality control.

E. Manufacturer-provided field quality control.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 07 9100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.

C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

D. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.

C. ASTM C834 - Standard Specification for Latex Sealants; 2014.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

L. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

M. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

N. SWRI (VAL) - SWR Institute Validated Products Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification requirements.
10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Shop Drawings for Joint Sealants: Submit project specific details, project specific joint sealant schedule, floor plans, elevations, ceiling plans and details indicating joint sealant types corresponding to the joint sealant schedule. Submit four weeks prior to Installation Plan submittal.
   1. Included with the shop drawings provide the following details keyed into the schedule as they apply to the conditions of this Project:
      a. Depth and material type for sealant and backer rods shall be as per manufacturer recommendations and Industry Best Practices:
      b. Provide single sealant joints over backer rod, using specified material at the following exterior locations:
         1) All horizontal joints beneath copings and wall caps.
         2) All horizontal joints at brick shelf angles.
         3) All vertical joints, i.e. expansion and control joints. Exception: vertical joints of copings and wall caps are to be double sealant joints.
      c. Provide double sealant joints at the following exterior locations:
         1) All horizontal surfaces. Note: turn down the sealant a minimum of two (2) inches over the front edge of the horizontal surface.
         2) All joints at coping and wall caps.
         3) All vertical joints at large entablatures and cornice trim of precast, stone, etc.

E. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing full line of standard colors available for selection.

F. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

H. Installation Plan: Submit at least four weeks prior to start of installation.

I. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

J. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

K. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

L. Installation Log: Submit filled-out log for each length or instance of sealant installed.

M. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
   4. Allow sufficient time for testing to avoid delaying the work.
   5. Deliver sufficient samples to manufacturer for testing.
   6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Installation Plan: Include schedule of sealed joints, including the following:
   1. Joint width indicated in Contract Documents.
   2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
   3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgment that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
   4. Approximate date of installation, for evaluation of thermal movement influence.

F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Name(s) of sealant manufacturer's field representatives who will be observing.
   3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
      b. Test date.
      c. Location on project.
      d. Sealant used.
      e. Copy of test method documents.
      f. Age of sealant upon date of testing.
      g. Test results, modeled after the sample form in the test method document.
      h. Indicate use of photographic record of test.

G. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
   1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.

H. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.

a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.

3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

I. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

J. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
1. Record results on Field Quality Control Log.
2. Repair failed joints, having a length of 48 inches, or less.
3. Repair failed portions of joints having increments of 48 inches or more.

K. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints in their entirety..

L. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

1.06 WARRANTY

A. Correct defective work as follows: after the Date of Substantial Completion:
1. Exterior Sealants: Twenty (20) Years.
2. Interior Sealants : Ten (10) Years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
2. Dow Corning® Corporation: www.dowcorning.com/construction.
3. Tremco Global Sealants: www.tremcosealants.com.

4. Sherwin-Williams Company: www.sherwin-williams.com.

B. Self leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   2. Dow: www.dow.com/#sle.
   3. Tremco Global Sealants: www.tremcosealants.com.
   4. Sika Corporation: www.usa-sika.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items and require redundant (double sealant Joints).
      a. Joints between different exposed materials and changes in plane where the material is not continuous.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. 1/4 inch Joints between door, window, and other frames and adjacent construction including casings and standing and running trim, including base boards..
      b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
         1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
   3. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be covered with expansion joint cover assemblies.
      c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
      d. Joints where sealant installation is specified in other sections.
      e. Joints between suspended ceilings and walls.

B. Exterior Joints: Use nonsag Low Modulus and Ultra Low Modulus Silicone sealant, Type S-1, S-1a, unless otherwise indicated.

C. Interior Joints: Use nonsag polyurethane, or Silyl Terminated Polyether (STPE) sealant, Type S-2, unless otherwise indicated.
   1. Wall and Ceiling Joints in Non-Wet Areas: urethane or paintable STPE sealant; Type S-2.
   2. Wall and Ceiling Joints in Wet Areas: Non-sag Silicone sealant for continuous liquid immersion; Type S-1b.
   3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear; Type S-1b.
   4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant; Type AC.
   5. Other interior Floor Joints: Self-leveling polyurethane "traffic-grade" sealant; Type SL-2.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

F. Areas Where Tamper-Resistance is Required: Type S-2a, S-2aa.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.

B. Colors: As Selected from Manufacturer's full range of available options..

2.04 NONSAG JOINT SEALANTS

A. Type S-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Applications: General exterior use M: Metal to metal, MA: Masonry control joints, etc.
   2. Movement Capability: Plus and minus 50 percent, minimum.
   3. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   4. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   5. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   6. Color: As selected by Architect from Manufacturer's full range of available options..
   7. Cure Type: Neutral.
   8. Service Temperature Range: Minus 20 to 180 degrees F.
   9. Products: Basis of Design.
      a. Dow Corning Corporation; 795 Silicone Building Sealant: www.dowcorning.com/construction.
   10. Other Acceptable Products:
      a. Tremco® Global Sealants and Waterproofing Product Spectrem® 2 high-performance, single-component, neutral-cure, Spectrem® 2 .
      b. Sika® Corporation; Sikasil® WS-290: www.usa-sika.com.
         1) Substitutions: See Section 01 6000 - Product Requirements.

B. Type S-1a - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Applications: Exterior use for joints between dissimilar materials such as between metals and masonry, or other locations requiring greater movement capability. (M A,
   2. Movement Capability: Plus and minus 50 percent, minimum.
   3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   4. Color: custom.
   5. Cure Type: Single component, neutral moisture curing.
   6. Service Temperature Range: Minus 65 to 180 degrees F.
   7. Products:
      a. Dow Corning® Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction.
      b. Sika® Corporation; Sikasil® WS-295: www.usa-sika.com.
      c. Sika® Corporation; Sikasil 728NS: www.usa-sika.com.
      d. Sikasil® WS-295.

C. Type S-1b - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: Clear.
   2. Products:
      a. Basis of Design Product: DOW CORNING® 786 SILICONE MILDEW RESISTANT SEALANT manufactured by Dow Corning Corporation: www.dowcorning.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Type (S-1sg) : Structural Glazing Sealant: Product Dow Corning® 121 Structural Glazing Sealant

E. Type 2a - Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Products:
    a. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: www.sherwin-williams.com/#sle.
    b. Sherwin-Williams Company; Stampede 1H Hybrid Sealant: www.sherwin-williams.com/#sle.
    c. Pecora Corporation; DynaFlex SC Polyurethane STPU Security Sealant: www.pecora.com.
    d. Sika Corporation; SikaHyflex-150 LM: www.usa-sika.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

F. Type S2aa - Tamper-Resistant, Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Products:
    a. MasterSeal® NP 150™
    b. Pecora Corporation; DynaFlex SC (Security Sealant): www.pecora.com/#sle.
    c. Sika Corporation; SikaHyflex-150 LM: www.usa.sika.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

G. Type S-2 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Color selected, or paint to Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Products:
    a. BASF Corporation Product Master Seal NP 1: www.master-builders-solutions.basf..com
    b. Pecora Corporation; DynaTrol II: www.pecora.com/#sle.
    c. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
    d. Tremco Global Sealants Product Dymonic® 100: www.trmco.com

H. Type SW - Polyurethane Sealant for Continuous Water Immersion: 1, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Products:
    a. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

I. Type AC-1 - Acoustical Sealant: Acrylic-Urethane Sealant: Water-based; 1, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Color: White.
3. Service Temperature Range: Minus 40 to 180 degrees F.

J. Basis of Design Product: SHEETROCK® Brand Acoustic Sealant manufactured by United States Gypsum Company: www.usg.com.

K. Other Acceptable Manufacturers:

1. Franklin International, Inc; Titebond UA 920 Sealant: www.titebond.com.
2. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.05 SELF-LEVELING JOINT SEALANTS

A. Type TS-1 - Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
   3. Color: Color as selected.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Products:
      a. Dow Corning® 890-SL SILICONE JOINT SEALANT
      b. Sika Corporation; Sikasil 728SL: www.usa.sika.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Type TS-2 - Indoor Use Only, Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's full range.
   4. Manufacturers: Basis of Design
      a. Master® Builders Solutions Product MasterSeal SL 1® Self-Leveling Sealant: www.basf.com.
   5. Other Acceptable Manufacturers
      a. Pecora Corporation: www.pecora.com.
      b. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.

C. Type TS-3 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's full range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers: Basis of Design
      a. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
   6. Other Acceptable Manufacturers
      a. BASF Master® Builders Solutions; Product SL 2®.
      b. Tremco® Commercial Sealants and Waterproofing; ProductDymeric® 240: www.tremcosealants.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Type TS-4 - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multicomponent, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   3. Color: Concrete gray.
   4. Joint Width, Minimum: 1/8 inch.
   5. Joint Width, Maximum: 1/4 inch.

6. Products:
    a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
    b. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
    1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: 1; Type C - Closed Cell Polyethylene.
    2. Type for Joints Subject to Pedestrian or Vehicular Traffic: 1; Type C - Closed Cell Polyethylene.
    3. Products:
        a. Industrial Thermo Polymers Limited; Product TUNDRA® FOAM : www.tundrafoam.com
        b. Bay Companies Inc. Product Mile High Foam® open cell backer rod: www.bayindustries.com
        c. C.R. Laurence Co., Inc. Product CRL Open Cell Backer Rod: http://www.crlaurence.com/.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
    1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
    2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
    3. Arrange for sealant manufacturer's technical representative to be present during tests.
    4. Record each test on Preinstallation Adhesion Test Log as indicated.
    5. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
    6. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type S-1; colors as selected.

B. Control and Expansion Joints in Paving: Type S-4.

C. Control, Expansion, and Soft Joints in Masonry, and Between Masonry and Adjacent Work: Type S-1.

D. Joints Between Exterior Metal Frames and Adjacent Work (except masonry): Type S-1.

E. Under Exterior Door Thresholds: Type S-5.

F. Interior Joints for Which No Other Sealant is Indicated: Type S-2; colors as shown on the drawings.

G. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type S-3.

3.04 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. 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.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: Tool flush prior to full cure,

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

D. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

F. Repair destructive test location damage immediately after evaluation and recording of results.

3.06 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION 07 9200

SECTION 07 9513

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.02 RELATED REQUIREMENTS

C. Section 09 2116 – Gypsum Board Assemblies: Placement of joint cover assembly frames in gyp. board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

D. ASTM B455 - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2010 (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, effected adjacent construction, and anchorage locations.

D. Samples: Submit two samples 12 inch long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1 See Section 01 6000 for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1 Architectural Art Mfg., Inc;: www.archart.com/#sle.
   2 Construction Specialties, Inc: www.c-sgroup.com/#sle.
   3 MM Systems Corp: www.mmsystemscorp.com/#sle.
   4 Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1 Joint Dimensions and Configurations: As indicated on drawings.
   2 Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3 Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4 Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

B. Resilient Filler: Silicone, exhibiting Shore A hardness of 40 to 50 Durometer.

C. Threaded Fasteners: Stainless steel.

D. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.04 FABRICATION

A. Joint Covers: Aluminum cover plate, aluminum frame construction, retainers with resilient elastomeric filler strip, designed to permit plus or minus 50 percent joint movement with full recovery, flush mounted.

B. Back paint components in contact with cementitious materials.

C. Galvanize embedded ferrous metal anchors and fastening devices.

D. Shop assemble components and package with anchors and fittings.

E. Provide joint components in single length wherever practical. Minimize site splicing.

2.05 FINISHES

A. Floors: As selected by Architect.

B. Walls and Ceilings: As selected by Architect.

C. Resilient Filler Exposed to View: As selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 PREPARATION

A. Provide anchoring devices for installation and embedding under Section 03 1000.
   1 Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.04 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

3.05 SCHEDULES SEE DRAWINGS

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Flush Wood Doors

B. Section 08 7100 - DOOR HARDWARE.

C. Section 08 8000 - Glazing: Glass for doors.

D. Section 09 9113 - Exterior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

K. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

L. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

N. ASTM C236 - Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box; 1989 (Reapproved 1993).

O. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

Q. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings; 2017.

R. ASTM E413 - Classification for Rating Sound Insulation; 2010.

S. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

T. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

U. FLA (PAD) - Florida Building Code Online - Product Approval Directory; Current Edition.

V. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

W. ITS (DIR) - Directory of Listed Products; current edition.

X. Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

Y. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.

Z. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

AA. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

AB. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

AC. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.

AD. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.

AE. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

AF. NAAMM HMMA 862 - Guide Specifications for Commercial Security Hollow Metal Doors and Frames; 2013.

AG. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames; 2013.

AH. NAAMM HMMA 866 - Guide Specifications for Stainless Steel Hollow Metal Doors and Frames; 2012.

AI. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

AJ. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

AK. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

AL. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

AM. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

AN. UL (DIR) - Online Certifications Directory; Current Edition.

AO. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AP. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AQ. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, louvers, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit two samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.

E. Design Submittals: Manufacturer to submit anchor design analysis calculations for blast-resistant doors signed and sealed by specialty design engineer experienced in this type of work and licensed in Alabama.

F. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

G. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Place units on wood skids and store in manner that will prevent corrosion and damage. Adequately brace frames during construction to ensure no deflection.

D. Store assemblies upright, do not stack flat.

E. Adequately brace frames during construction to ensure no deflection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Mesker, Mesker Openings Group: www.meskerdoor.com
   3. Republic Doors: www.republicdoor.com.
   4. Steelcraft: www.steelcraft.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
1. Based on NAAMM HMMA Custom Guidelines:
    a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
    b. Performance Level 1 - Light Duty, in accordance with NAAMM HMMA 805.
    c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
    e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
2. Grade: NAAMM HMMA 861, physical performance Level A.
3. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
4. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
5. Door Thickness: 1-3/4 inches, nominal.
6. Top Closures for Outswinging Doors: Flush with top of faces and edges.
7. Door Face Sheets: Flush.
8. Insulating Value: Minimum U-value of 0.50, when tested in accordance with ASTM C 1363 or ASTM C 236.
9. Weatherstripping: Refer to Section 08 7100.

C. Interior Doors, Non-Fire Rated:
1. Based on NAAMM HMMA Custom Guidelines:
    a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
    b. Performance Level 1 - Light Duty, in accordance with NAAMM HMMA 805.

c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.
4. Door Finish: Factory primed and field finished.

D. Fire-Rated Doors:
1. Based on NAAMM HMMA Custom Guidelines: Comply with NAAMM HMMA 850 requirements for fire-rated doors.
a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
b. Provide units listed and labeled by UL, FM or WH.
c. Attach fire rating label to each fire rated unit.
d. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
1) Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
2) Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
3) Label: Include the "S" label on fire-rating label of door.
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.
5. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. General:
1. Comply with the requirements of grade specified for corresponding door, except:
a. Frames for exterior locations, oversized openings, and rated assemblies: Comply with frame requirements specified in ANSI A250.8 Level 3 Doors: 14 gage frames.
2. Back prime frames in exterior locations, wet locations, and grouted frames with bituminous coating.
3. A minimum 3/8" joint should be maintained between adjacent veneer masonry and frame head and jamb.

D. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 7100.

E. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Frame Finish: Factory primed and field finished.

F. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Finish: Factory primed and field finished.

G. Sound-Rated Door Frames: Fully welded type, or type as per Manufacturer.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Frame Finish: Factory primed and field finished.

H. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

I. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

J. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

K. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

L. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 ACCESSORIES

A. Louvers: Roll formed steel with concealed frame; finish same as door components; factory-installed.

B. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
1. Style: Lightproof design.
2. Louver Free Area: 50 percent.
3. Fasteners: Concealed fasteners.

C. Louvers: Specified in Division 08 and 23.

D. Glazing: As specified in Section 08 8000, factory installed.

E. Removable Stops: Rolled steel bar, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws. Place glazing stops on secure side of opening.

F. Astragals for Double Doors: Specified in Section 08 7100.

G. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

H. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

I. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, zinc molybdate type.

B. Bituminous Coating for door frames to be installed in masonry construction and grouted solid.: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

1. Fire-Rated Frames: Comply with fire rating requirements indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Fit hollow metal doors accurately in frames, with clearances specified in SDI-100.

B. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames in masonry construction as indicated in drawings, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Coordinate installation of hardware. Provide reinforcement at all hardware attachment locations.

G. Comply with glazing installation requirements of Section 08 8000.

H. Coordinate installation of electrical connections to security and electrical hardware items.

I. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

C. Adjust Standard Steel door frames for squareness, alignment, twist and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measure at jambs on a horizontal line parallel to the plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corner of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 1113

SECTION 08 1416

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM E413 - Classification for Rating Sound Insulation; 2010.

C. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

G. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

H. ICC (IBC) - International Building Code; 2012.

I. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

J. LMA (VPS) - Voluntary Product Standards and Typical Physical Properties of Decorative Overlays; Composite Panel Association; 2004.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

M. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

N. National Wood Window & Door Association

O. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

P. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

R. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

S. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for hardware and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door construction, 12 by 12 inches in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 12 by 12 inches in size illustrating wood grain, stain color, and sheen.

F. Test Reports: Show compliance with specified requirements for the following:
   1. Acoustical Door Assemblies; sealed panel tests are not acceptable.
   2. Electromagnetic shielded doors and frames.

G. Shop Drawings: Illustrate comprehensively door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria..

H. Manufacturer's Installation Instructions: Indicate special installation instructions.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS FLUSH WOOD DOORS

A. Wood Veneer Faced Doors: Basis of Design
   1. Graham Wood Doors:; Product Graham Premium Door Series: www.grahamdoors.com.

B. Other Acceptable Manufacturers
   1. Eggers Industries: www.eggersindustries.com/#sle.
   2. Algoma Hardwoods, Inc.www.algoma.com
   3. Fenestra Corp. :www.fenestra.com
   4. Weyhauser Co.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S.1-A and with AWI/AWMAC/WI Architectural Woodwork Standards..
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.03 DOOR LEAF CONSTRUCTION - WOOD VENEER DOORS

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type framed non-bonded structural composite lumber core (FSCLC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Species to match Architect's sample, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face. Stain to match existing doors.
   1. Vertical Edges: Compatible hardwood.
   2. "Running Match" each pair of doors and doors in close proximity to each other.
   3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Provide solid blocks at lock edge for hardware reinforcement.
   1. Provide solid blocking for throughbolted hardware.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal all door faces and edges with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 1113.

B. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for additional hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. Install door louvers plumb and level.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE SEE DOOR SCHEDULE ON DRAWINGS

END OF SECTION 08 1416

SECTION 08 3100

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, non-fire-rated, in wall and ceiling locations.

1.02 RELATED REQUIREMENTS

A. Section 09 2116: Openings in ceilings.

B. Section 09 9000 - Painting: Field paint finish.

C. Section 23 3300 - Air Duct Accessories: Access doors in ductwork.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

2.02 MANUFACTURERS

A. Access Doors:
   1. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   2. Barco Access Doors by Metal Service C., Inc.
   3. J.L. Industries
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.04 WALL AND CEILING MOUNTED UNITS

A. Door and Frame Units: Formed steel.
   1. Frames and flanges: 0.058 inch steel.
   2. Door panels: 0.070 inch single thickness steel sheet.
   3. Door/Panel Size: As indicated on the drawings.
      a. Walls: 8 x 8 inches.
      b. Ceilings: 24 x 24 inches minimum size with flange to receive drywall finish.
   4. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      b. Hinge: Concealed constant force closure spring type and an interior release handle.
      c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
   5. Galvanized, hot dipped finish.

6. Finish: One coat baked enamel, to match adjacent surface color.
7. Acudor Products, Inc.
8. Babcock Davis; A Sierra Products Co.
9. JL Industries, Inc.
10. Karp Associates, Inc.
11. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 4313

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront.

B. Aluminum glazed doors and frames.

C. Weatherstripping.

D. Door hardware.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Steel attachment members.

B. Section 07 8400 - Firestopping: Firestop at system junction with structure.

C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 08 1416 – Flush Wood Doors: Wood doors mounted in storefront frames.

D. Section 08 4413 - Glazed Aluminum Curtain Walls.

E. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

F. Section 08 8000 - Glass And Glazing: Glass and glazing accessories.

G. Section 09260 - Gypsum Board Assemblies for interior storefront installation in drywall construction.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

J. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

M. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

N. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section; require attendance by all affected installers.

C. Prerequisite Requirements
1. Do not schedule meeting before all required submittals have been reviewed and approved.
2. Mock up (if required) has been constructed and tested.
3. Openings are prepared to receive assemblies.

1.05 PERFORMANCE REQUIREMENTS

A. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

B. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.

C. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.

D. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.

F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.06 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details .

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

a. Delegated Design Requirement Shall Include Design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Manufacturer's installation Instructions.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulating Glass Certification Council (IGCC).
      b. Safety Glazing Certification Council (SGCC).

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
      a. North American Contractor Certification (NACC) for glazing contractors.
      b. Equivalent independent third-party ANSI accredited certification.

1.08 MOCK-UPS

A. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

B. Locate where directed.

C. Mock-up may remain on site as representative of the minimum acceptable execution for quality and Craftsmanship for this part of The Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.10 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.11 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of components exhibiting excessive fading, chalking, peeling, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Aluminum-Framed Storefronts and Entrances: Basis of Design. Subject to compliance with requirements provide systems from one of the following Manufacturers:
   1. YKK AP America, Inc: www.ykkap.com/commercial
      a. ProTek® product Series YHS 50 TU (Exterior),

b. YES 45 TU (Interior)
c. YES 40 FS (Interior)

B. Aluminum-Framed Storefronts and Entrances: Other Acceptable Manufacturers
1. Kawneer North America; IR 501: www.kawneer.com/#sle.
2. Oldcastle BuildingEnvelope; FG-5750T StormMax®: www.oldcastlebe.com
3. Trulite Glass & Aluminum Solutions, LLC; Resistor Impact CG501 Series: www.trulite.com
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Position: Centered (front to back).
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
3. Finish: High performance organic coatings.
a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
4. Finish: See 08 4313, 2.05
5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.
12. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Performance Requirements:
1. Wind Loads (Doors and Frames): Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Design Wind Loads: Comply with requirements of ASCE 7.
b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, having Florida Building Code "FLA (PAD)" approval for Large and Small Missile impact and pressure cycling at design wind pressure.
3. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.

4. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
5. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Cross-Section: As indicated on drawings.

B. Glazing: See Section 08 8000.
   1. For Exterior Framing: Type IGU 1.

C. Swing Doors: Glazed aluminum.
   1. Basis of Design: Exterior Impact Resistant:
      a. YKK AP America, Inc; ProTek® product Series Model 50H.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Thickness: 2-3/8 inches (Impact Resistant, Exterior) 1-3/4 inches (Interior).
   3. Vertical Stiles and Top Rails: 5 inches wide.
   4. Bottom Rail: 10 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections: ASTM A36/A36M; shop primed.

D. Fasteners: Stainless steel.

E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

F. Concealed Flashings: Sheet aluminum, 22 gage, 0.030 inch minimum thickness.

G. Sill Flashing Sealant (exposed: Elastomeric, silicone compatible with flashing material.

H. Sealant for Setting Thresholds concealed) : Non-curing butyl type.

I. Glazing Gaskets: Preformed Silicone to suit application to achieve weather, moisture, and air infiltration requirements.

J. Glazing Accessories: See Section 08 8000.

K. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

L. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
   1. Manufacturers:
      a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
      b. Sherwin-Williams Company; SHER-NAR 5000: oem.sherwin-williams.com/#sle.
      c. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.

2. Color: As selected by Architect from Manufacturer's full range of available options including metallics.
3. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: As specified in Section 08 7100.

C. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors, sized for each specific opening depth/condition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

G. Install operating sash.

H. Set thresholds in bed of sealant and secure.

I. Install hardware using templates provided.
1. See Section 08 7100 for hardware installation requirements.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Test installed storefront for air infiltration in accordance with ASTM E-283.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
    a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 4313

SECTION 08 4413

GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall with vision and spandrel glazing.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Weld plates embedded in concrete for attachment of anchors.

B. Section 04 2000 - Unit Masonry Assemblies: Interface of masonry with curtainwall.

C. Section 05 1200 - Structural Steel Framing: Steel attachment members.

D. Section 05 5000 - Metal Fabrications: Steel attachment devices and miscellaneous support..

E. Section 07 2500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

F. Section 07 4213 - Metal Wall and Soffit Panels.

H. Section 07 8400 - Firestopping: Firestop at system through penetrations / connections with structure.

I. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

J. Section 08 4313 - Aluminum-Framed Storefronts: Entrance framing and doors.

K. Section 08 8000 - Glass and GLAZING.

L. Section 09 2116 - Gypsum Board Assemblies: Metal stud and gypsum board wall at interior of curtain wall.

M. Section 12 2300 - Roller Shade Systems: Attachments to framing members.

1.03 REFERENCE STANDARDS

A. AA DAF-45 - Designation System for Aluminum Finishes; The Aluminum Association, Inc.; 2003.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

C. AAMA 501.1 - Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure; 2005.

D. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

E. AAMA 501.4 - Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts; 2009.

F. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

G. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

H. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2015.

I. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

J. AAMA 1801 - Voluntary Specification for the Acoustical Rating of Exterior Windows, Doors, Skylights and Glazed Wall Sections; 2013.

K. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

L. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

M. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

N. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

O. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

P. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

Q. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

R. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

S. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.

T. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

U. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

V. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2015.

W. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

X. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

Y. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

Z. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential; 2000 (Reapproved 2009).

AA. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2010).

AB. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

AC. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2014.

AD. FLA (PAD) - Florida Building Code Online - Product Approval Directory; Current Edition.

AE. Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

AF. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section; require attendance by all affected installers.

C. Prerequisite Requirements

1. Do not schedule meeting before all required submittals have been reviewed and approved.
2. Mock up (if required) has been constructed and tested.
3. Openings are prepared to receive assemblies.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. **Contractor Note: Manufacturer's standard details, or other standard details shall not be acceptable as shop drawings. Shop drawings shall reflect the specific construction of this project as based on verification of actual as built conditions in the field which should, but may not exactly follow the Contract Drawings.**

E. Samples: For initial selection associated with choices for the comprehensive mock up, submit two 24 x 24 inches in size illustrating finished aluminum surface, glazing and glazing materials representing the range of available aluminum finishes in the specified color and the range of glass options matching the basis of design for the vision, spandrel and fritted insulating units. **NOTE: See Section 01 4000 Quality Requirements for Curtainwall / Glazing Sample Mock-up**

F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

G. Design Data: Provide framing member structural and physical characteristics with Sealed engineering design calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

H. Include with the engineering design method(s) of attachment and fastening.

I. Test Reports: Submit results of full-size mock-up testing.

J. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

K. Designer's Qualification Statement.

L. Manufacturer's Qualification Statement.

M. Installer's Qualification Statement.

N. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Alabama.

B. Full-Size Mock-Up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified thermal, structural, air infiltration, water penetration, and sound attenuation criteria.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulating Glass Certification Council (IGCC).
      b. Safety Glazing Certification Council (SGCC).

D. Installer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience.

1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
    a. North American Contractor Certification (NACC) for glazing contractors.
    b. Equivalent independent third-party ANSI accredited certification.

1.07 MOCK-UPS

A. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 01 3100.

B. Provide Curtainwall as part of required mock-up, as shown on Drawings, (or if not shown on drawings, as directed by Architect) including all components and accessories occurring as part the assembly. Construct to illustrate the complete component assembly including glazing materials, vertical weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate where directed.

D. Mock-up may remain on site as representative of the minimum acceptable execution for quality and Craftsmanship for this part of The Work.

E. See Section 01 4000 - Quality Requirements, for general requirements for mock-ups.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a 7 year period after Date of Substantial Completion.

C. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Curtain Walls Manufacturers: Basis of Design:
    1. YKK AP America, Inc; YHC 300 OG, Impact Resistant ProTek® Series: www.ykkap.com/commercial.

B. Other Acceptable Manufacturers, Glazed Aluminum Curtain Walls
    1. Kawneer North America; 1630 SS IR Curtain Wall System: www.kawneer.com.
    2. Oldcastle Building Envelope; Reliance™ StormMax® High Performance curtain wall : www.obe.com.
    3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Fabrication Method: Field fabricated stick system.
   3. Glazing Method: Field glazed system.
   4. Vertical Mullion Face Width: As indicated on drawings.
   5. Vertical Mullion Depth From Face of frame to Back of Frame: As indicated on drawings.
   6. Finish: Color anodized with organic seal.
      a. Factory finish surfaces that will be exposed to view in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   7. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   10. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
   11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   12. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads:
      a. Negative Design Wind Load: Comply with requirements of ASCE 7.
      b. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
      c. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span with full recovery of glazing materials.
      d. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
   2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.
   3. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.
   4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Movement of curtain wall relative to perimeter framing.
      c. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 20 psf.
2. Test Method: ASTM E331.

D. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.

2.03 SYSTEM COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Cross-Section: As indicated on drawings.
3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: See Section 08 8000.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections: ASTM A36/A36M; shop primed.

D. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.

E. Structural Supporting Anchors Attached to Reinforced Concrete Members: Design for welded attachment to weld plates embedded in concrete.

F. Fasteners: Factory Finished Galvanized steel; to match Curtainwall, type as required or recommended by curtain wall manufacturer.

G. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch minimum thickness; finish to match framing members.

H. Concealed Flashings: Stainless steel, 24 gage, 0.0239 inch minimum thickness.

I. Firestopping: See Section 07 8400.

J. Weatherseal Sealant: See Section 07 9200 - Joint Sealants: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

K. Perimeter Sealant: as specified in Section 07 9200.

L. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

M. Glazing Accessories: See Section 08 8000.

N. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

O. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
1. Manufacturers:
a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
b. Sherwin-Williams Company; SHER-NAR 5000: oem.sherwin-williams.com/#sle.
c. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.

2. Color: As selected by Architect from Manufacturer's full range of available options including metallics.
3. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Install firesafing at each floor slab edge full depth of the slab.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Pressure Plate Framing: Install glazing and infill panels using exterior dry glazing method; see Section 08 8000.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet noncumulative or 0.5 inches per 100 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's field representative and Envelope Commissioning Agent to observe installation and make report.

B. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.

C. Test installed curtain wall for water leakage in accordance with ASTM E1105 with a uniform test pressure difference of 4.50 lbf/sq ft.

D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 4413

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Double Pane Insulating glass units.

B. Single pane float glass Units.

C. Tempered Float Safety Glass Units

D. Laminated Safety Glass Units

E. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers.

B. Section 07 9200 - Joint Sealants: Sealants for glazing and related weatherproofing purposes.

C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

D. Section 08 1416 - Flush Wood Doors: Glazed door lights.

E. Section 08 5113 - Aluminum Windows: Glazing specified in this Section and installed by window manufacturer.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM C1036 - Standard Specification for Flat Glass; 2011.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (GM) - GANA Glazing Manual; 2009.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

P. ICC (IBC) - International Building Code; 2018.

Q. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

R. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

S. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

T. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

U. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Exterior Envelope Preinstallation Meeting: In addition to individual preinstallation meetings for specific products, a comprehensive meeting for the entire exterior wall assembly will be conducted with all affected parties represented, to be scheduled by the Contractor. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved. Convene one week before starting work of this section; require attendance by all affected installers.

C. Prerequisite Requirements
1. Do not schedule meeting before all required submittals have been reviewed and approved.
2. Mock up (if required) has been constructed and tested.
3. Openings are prepared to receive assemblies.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and monolithic float glass, including tempered and laminated safety Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inches in size of each glass type and configuration, i.e., clear float, insulating unit, tempered, laminated, etc.

E. Samples: Submit 6 inch long bead of glazing sealant, color as selected.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years documented experience.

1.07 MOCK-UPS

A. Mockup - Exterior Wall Assembly: After sample panel review, and prior to the installation of any exterior wall finish materials (precast, masonry, metal panel, windows, louvers, etc.) on the building, the Wall Assembly mockup shown on the Drawings shall be erected, reviewed by Owner and Architect, modified as necessary by the Contractor to address review comments, and the assembly fully approved. Provide complete mockup for review within 90 days of Notice to Proceed, or sooner if required for material lead times. Final approval will be provided based on the fully approved exterior wall assembly mockup for product finish and color selections. See Section 03100.

B. Locate where directed.

C. Mock-up may remain on site as representative of the minimum acceptable execution for quality and Craftsmanship for this part of The Work.

D. See Section 01 4000 - Quality Requirements, for general requirements for mock-ups.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a fifteen (15) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.

B. Float Glass Manufacturers: Basis of Design
   1. Vitro® Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

C. Other Acceptable Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.

D. Laminated Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

E. Tempered Safety Glass Manufacturers: Basis of Design
   1. Vitro® Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

F. Other Acceptable Tempered Safety Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Substitutions: Refer to Section 01 6000 - Product Requirements.

G. Privacy Glass Manufacturers:
   1. GGI - General Glass International; Patterned Glass: www.generalglass.com/#sle.
   2. Oldcastle Building Envelope; Obscure Glass: www.obe.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7 and other applicable codes.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain complete continuity of building enclosure "Dry Line".
   1. In conjunction with weather barrier related materials described in other sections.
   2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
   3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATING GLASS UNITS

A. Manufacturers: Basis of Design
   1. Vitro® Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

B. Other Acceptable Manufacturers specified for float glass.
   1. Guardian Glass, LLC: www.guardianglass.com
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Warm-Edge Spacers: Low conductivity thermoplastic and stainless steel.
      a. Spacer Width: 1/2 inch.
      b. Spacer Height: 0.25 inch, or manufacturer's standard.
   4. Spacer Color: Aluminum.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
   6. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.

E. Type IG-2 - Insulating Glass Units: Vision Glass, double glazed.
   1. Applications: Interior glazing as indicated on drawings.

2. Space between lites filled with air.
3. Outboard Lite: Heat-strengthened, (tempered, laminated where required) float glass.
   a. Tint: Clear.
4. Inboard Lite: Heat-strengthened, (tempered, laminated where required) float glass
   a. Tint: Clear
   b. Coating: none.
5. Total Thickness: 1 inch.
6. Glazing Method: Dry glazing method, gasket glazing.

2.05 GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on drawings.
   2. Glass Type: SG-1 - Fully tempered (laminated where required) float glass.
   3. Tint: Clear. Acuity® Low Iron Clear float Glass: Vitro® Architectural Glass: http://www.vitroglazings.com
   4. Thickness: .25 inch nominal for tempered glass, 0.28 inch, nominal (0.125 inch + 0.03 inch for tempered glass nominal 0.125 inch ,.
   5. Visible Light Transmittance (VLT): 90 percent, nominal.
   6. Solar Heat Gain Coefficient (SHGC): 0.87, nominal.
   7. Visible Light Reflectance, Outside: 8 percent, nominal.
   8. Glazing Method: Wet/dry glazing method, preformed tape and sealant.

2.06 PLASTIC FILMS PRODUCTS

A. Manufacturers: Basis of Design.
   1. 3M Window Films: solutions.3m.com/wps/portal/3M/en_.

B. Schedule - Privacy Applied Plastic Film: Mylar type.
   1. Type WF-1: 3M Privacy, White Matte Translucent Film. Provide on windows in rooms 209 and 210.
   2. Type WF-2: 3M Privacy, Mirror Film. Provide on windows in room 272.

C. Applications: Configured as indicated on drawings.

2.07 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

C. Manufacturers: See Section 07 9200 - Joint Sealants

2.08 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

1. Width: As required for application.
2. Thickness: As required for application.
3. Spacer Rod Diameter: As required for application.
4. Manufacturers:
    a. Pecora Corporation: www.pecora.com/#sle.
    b. Tremco Global Sealants: www.tremcosealants.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points and install glazing pane or unit.

C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.

D. Fill gaps between glazing and stops with silicone type sealant to depth of bite on glazing, 3/8 inch maximum depth below sight line to ensure full contact with glazing and continue the air and vapor seal.

E. Apply sealant to uniform line, flush with sight line. Tool sealant surface smooth.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces only when sealants have sufficiently cured.

E. Clean glass on both exposed surfaces during final cleaning after interior cleaning and exterior landscape and other dust generating activities are complete prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.09 SCHEDULES (SEE DRAWINGS)

END OF SECTION 08 8000

SECTION 08 8300

MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Tempered safety glass.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking support.

B. Section 09 211 6 - Gypsum Board Assemblies: Concealed metal support accessories for mounting to gypsum board on metal framing.

1.03 REFERENCE STANDARDS

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. GANA (GM) - GANA Glazing Manual; 2009.

F. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples, 12 x 12 inch in size, illustrating mirrors design, edging, and coloration.

E. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.
   1. Maintain one copy on project site.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Binswanger Mirror/ACI Distribution: www.binswangerglass.com/#sle.
   2. Lenoir Mirror Co: www.lenoirmirror.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
   1. Size: As indicated on drawings.

2.03 GLAZING COMPOUNDS

A. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component; chemical or solvent curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; clear, or black color, depending upon finish edge of mirror

2.04 ACCESSORIES

A. Glazing Clips: Manufacturer's standard type.

B. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
   1. Application Temperature: Minus 35 to 140 degrees F at contact surfaces.
   2. Manufacturers: Basis of Design

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Installation in Frames:
   1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
   2. Place setting blocks at one-quarter points with edge block no more than 6 inches from corners.
   3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
   4. Place glazing tape on free perimeter of mirrors in same manner described above.

5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Trim protruding tape edge.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION 08 8300

SECTION 08 9100

LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.

B. Section 07 6200 - Sheet Metal Fabrications, Flashing and Trim.

C. Section 07 9200 - Joint Sealants. Sealing joints between louver frames and adjacent construction.

D. Section 08 1113 - Hollow Metal Doors and Frames: Door louvers.

E. Section 08 1416 - Flush Wood Doors: Fixed door louvers.

F. Section 08 4413 - Glazed Aluminum Curtain Walls: Prepared openings for louvers.

G. Section 08 9200 - Louvered Equipment Enclosures.

H. Section 23 0913 - Instrumentation and Control Devices for HVAC: Actuators for operable louvers.

I. Section 23 0923 - Direct-Digital Control System for HVAC: Actuators for operable louvers.

J. Section 23 0943 - Pneumatic Control System for HVAC: Actuators for operable louvers..

K. Section 23 3100 - HVAC Ducts and Casings: Ductwork attachment to louvers, and blank-off panels.

L. Section 23 3300 - Air Duct Accessories: Fire/smoke dampers associated with exterior wall louvers.

M. 23 3423 - HVAC Power Ventilators: Operating Louvers

N. Section 23 3700 - Air Outlets and Inlets: Operating louvers.

O. Section 23 0923 - Direct-Digital Control System for HVAC: Actuators for operable louvers.

P. Section 23 0913 - Instrumentation and Control Devices for HVAC: Actuators for operable louvers.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.

D. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 PROJECT CONDITIONS

A. Coordinate work of this section with installation of masonry flashings.

B. Coordinate work of this section with installation of mechanical ductwork and electrical services to motorized devices.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
   1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

B. Storm Resistant Louvers and Grilles: Basis of Design.
   1. Wall Louvers and Grilles: Basis of Design
      a. Greeenheck; EHH-601D: greenheck.com
   2. Other Acceptable Manufacturers subject to compliance:
      a. Airolite Company, LLC: www.airolite.com
      b. Construction Specialties, Inc: www.c-sgroup.com.
      c. Ruskin Company: www.ruskinco.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load 50 PSF Minimum without damage or permanent deformation Per ASCE 7 for the area project location.
   2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   4. Screens: Provide insect screens and bird screens at intake louvers and bird screens at intake and exhaust louvers.
   5. Hinged Units: Provide secondary frame to which louver frame is attached; Stainless Steel hinges.

B. Stationary Louvers: Horizontal blade, extruded aluminum formed galvanized steel sheet construction, with intermediate mullions matching frame.
   1. Free Area: 50 percent, minimum, or as specified elsewhere.
   2. Blades: V-shaped, sight-proof.
   3. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
   4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
   5. Steel Finish: Superior performing organic coating, finished after fabrication.
   6. Color: Custom, to match approved sample.

C. Operable Louvers: Operable horizontal blades, extruded aluminum construction.
   1. Free Area: 50 percent, minimum.
   2. Operation: Actuator provided in HVAC control system.
   3. Movable Blades: Drainable, pivoted at, with vinyl, rubber, or polyethylene blade edge and jamb seals; rattle-free linkage .
   4. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
   5. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
   6. Metal Thickness: Frame 0.081 inch; blades 0.081 inch.
   7. Finish: Fluoropolymer coating, finished after fabrication.
   8. Color: Custom, to match approved sample.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

C. Stainless Steel: ASTM A666, Type 304, soft temper, smooth surface, No. 4 brushed finish.

D. Bird Screen: Interwoven wire mesh of steel, 0.063 inch diameter wire, 1/2 inch open weave, diagonal design.

E. Insect Screen: 18 x 16 size aluminum mesh.

F. Polyvinylidene Fluoride Coating: Minimum 70 percent Kynar 500/Hylar 500 resin, two coat finish, complying with AAMA 2604.

G. Primer: Zinc chromate, alkyd type.

2.04 FINISHES

A. Primer: Zinc chromate, alkyd type.

2.05 ACCESSORIES

A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Fasteners and Anchors: Stainless steel.

D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

F. Sealant: Silicone type, as specified in Section 07 9005.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant and backing rod in accordance with Section 07 9005.

F. Coordinate with installation of louver actuators.

3.03 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

3.05 SCHEDULES SEE DRAWINGS

END OF SECTION 08 9100

SECTION 09 2116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal grid ceiling framing systems and accessories:
   1. Flat Ceilings
   2. Soffits

D. Shaft wall system.

E. Fire rated area separation walls.

F. Acoustic insulation.

G. Fiberglass Mat Faced Gypsum sheathing.

H. Cementitious backing board.

I. Gypsum wallboard.

J. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 1000 - Rough Carpentry: wood blocking for support of wall mounted components .

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

F. Section 07 9005 - Joint Sealers: Acoustic sealant.

G. Section 09 9000 - Painting and Coating

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016.

B. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members; 2015.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015.

D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

F. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

H. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

I. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

J. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

L. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

M. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

N. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

P. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

T. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

V. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

W. ASTM E413 - Classification for Rating Sound Insulation; 2010.

X. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association; 2007.

Y. GA-216 - Application and Finishing of Gypsum Board; 2013.

Z. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

AA. GA-253 - Recommended Specifications for the Application of Gypsum Sheathing; Gypsum Association; 1999.

AB. GA-600 - Fire Resistance Design Manual; 2015.

1.04 SYSTEM DESCRIPTION

A. Acoustic Attenuation for Interior demising Partitions : STC of 50-54 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

B. Shaft Wall: Configure and install components as required to achieve the following performance levels:
   1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 50 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures and grouping with other interior finish submittals.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals, control joints, soffits detail trim and material transitions.
   1. Include plans with designation as to location and extent of each different type board material specified, and special treatment such as acoustic insulation, etc.

C. Product Data: Provide data on drywall metal stud wall framing, ceiling suspension and soffit systems, gypsum board, accessories, joint finishing system, and detail trim and accessories.
   1. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.06 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
   1. Maintain one copy of standards at project site.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum ten years of documented experience with projects of similar size and type..

C. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.07 REGULATORY REQUIREMENTS

A. Conform to 2021 International Building Code for fire rated assemblies as indicated on drawings.

1.08 PREINSTALLATION MEETING

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section, but not before construction and approval of mockup and all related submittals have been submitted, reviewed and returned with any comments if necessary. Conduct Preinstallation meeting in conjunction with ALL related interior finish components and related work as outlined in Section 01 7000. Include other affected Contractors and Subcontractors affected by the Work.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.

C. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 10 lbf/sq ft with maximum mid-span deflection of L/360.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Metal grid ceiling framing systems and accessories: Provide completed assemblies complying with the following
      a. Flat Ceilings: ASTM C635 Heavy-duty main beam classification, ASTM A653 zinc-coated hot dipped galvanized steel. Exposed surfaces chemically cleansed, zinc-coated, and prefinished.
      b. Soffits

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Marino: www.marinoware.com.
   4. The Steel Network, Inc: www.SteelNetwork.com.

5. Telling Industries: www.tellingindustries.com.

C. Manufacturers - Ceiling and Soffit Framing Systems.
1. Basis of Design: Armstrong World Industries Product QUIKSTIX™ Drywall Ceilings; QUIKSTIX™ Soffits DGS for soffit and bulkhead framing

D. Other Acceptable Manufacturers
1. United States Gypsum Company Product USG Drywall Suspension System - Flat Ceilings / USG Drywall Suspension System - Wall to Wall (corridors and small rooms): www.usg.com
2. Chicago Metallic Product Chicago Metallic 600 Series Fire Rated and non fire rated Drywall Grid Systems **:** www.chicagometallic.com

E. Non-Loadbearing Framing System Components: ASTM C645; 20ga minimum, galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
a. Acceptable Products:
1) Dietrich Metal Framing; UltraSteel (tm): www.dietrichindustries.com.
2) Clark Western Building Systems; UltraSteel (tm): www.clarkwestern.com.
2. Studs: C-shaped with knurled or embossed faces.
3. Runners: U shaped, sized to match studs.
4. Ceiling Channels: C-shaped.
5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
6. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
a. Products:
1) Substitutions: See Section 01 6000 - Product Requirements.

F. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
1. Products:
a. Same manufacturer as other framing materials.

G. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Continental® Building Products (formelyLafarge North America Inc.): www.continental-BP.com.
4. Georgia-Pacific Gypsum: www.gpgypsum.com.
5. National Gypsum Company: www.nationalgypsum.com.
6. United States Gypsum Company: www.usg.com.

B. Gypsum Wallboard: Type X Paper-faced gypsum panels as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.

C. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.

D. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at all locations.
   2. At all assemblies use Type X board, UL or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 1/2 inch.
      b. Ceilings: 1/2 inch.
      c. Multi-Layer Assemblies: Thicknesses as required to achieve configuration indicated..
   4. Mold-Resistant, Paper-Faced Products:
      a. American Gypsum; M-Bloc IR Type X.
      b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
      c. Continental® Building Products (formelyLafarge North America Inc.); MOLD DEFENSE®
      d. Georgia-Pacific Gypsum; ToughRock Mold-Guard : www.gpgypsum.com.
      e. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com.
      f. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
      g. United States Gypsum Company; Sheetrock Brand Mold Tough Gypsum Panels.
   5. Glass Mat Faced Products:
      a. Georgia-Pacific Gypsum; DensArmor Plus.: www.gpgypsum.com
      b. Georgia-Pacific Gypsum; DensArmor Plus Fireguard C: www.gpgypsum.com.
      c. National Gypsum Company; Gold Bond eXP Interior Extreme Gypsum Panel:.www.nationalgypsum.com.
      d. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.www.nationalgypsum.com.
      e. Deck and Parapet Sheathing: Georgia Pacific Corporation product Densdeck Prime.
      f. United States Gypsum Company; USG Sheetrock® Brand Glass-Mat Panels Mold Tough®
   6. Unfaced Products:
      a. USG Corporation; Fiberock Aqua-Tough Interior Panels.
      b. USG Corporation; Fiberock Brand Panels--Abuse-Resistant.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Abuse Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   4. Type: Fire-resistance-rated Type X, UL or WH listed.
   5. Thickness: 5/8 inch.
   6. Edges: Tapered.

F. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including ceilings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
      a. Thickness: 1/2 inch.
      b. Thickness Type X: 1/2 inch.
      c. Products:

1) Custom Building Products; Wonder Board® Lite Backerboard: www.custombuildingproducts.com
2) National Gypsum Company; Perma Base® BRAND Cement Board .
3) USG Corporation; DUROCK® Cement Board Next Gen.
4) Substitutions: See Section 01 6000 - Product Requirements.

4. ASTM C 1178 Fiberglass Mat Water-Resistant Gypsum Backing Panel.
   a. Thickness: 1/2 inch (12.7 mm).
      1) Thickness Type X: 1/2 inch.
   b. Products:
      1) Continental® Building Products (formelyLafarge North America Inc.): www.continental-BP.com.
      2) Custom Building Products; Wonderboard.
      3) Georgia Pacific Gypsum DensShield® Tile Backer
      4) United States Gypsum Company; FIBEROCK® Aqua-Tough™ Tile Backerboard Panels: www.usg.com
      5) United States Gypsum Corporation; DUROCK® Cement Board Next Gen.
      6) Substitutions: See Section 01 6000 - Product Requirements.

G. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Regular and Type X, in locations indicated.
   4. Type X Thickness: 5/8 inch.
   5. Type C Thickness: 1/2 inch.
   6. Regular Wall Board Thickness: 5/8 inch.
   7. Edges: Tapered.
   8. Products:
      a. American Gypsum; M-Bloc® Type X interior gypsum panels (treated with AzoTech™ fungicide) .
      b. Continental® Buildiing Products(formelyLafarge North America Inc.): Weather Defense® Platinum Interior and Weather Defense® Platinum Interior Type X.
      c. Georgia-Pacific Gypsum LLC; DensShield® Tile Backer.
      d. National Gypsum Company; Gold Bond® BRAND e2XP® Interior Extreme® Gypsum Panel i.
      e. Temple-Inland Inc; ComfortGuard®.Water- and Mold-Resistant Gypsum Board
      f. USG Corporation; SHEETROCK® Brand Mold Tough® Gypsum Panels.

H. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 1/2 inch.
   3. Edges: Tapered.
   4. Products:
      a. American Gypsum; Interior Ceiling Gypsum Board.
      b. Georgia-Pacific Gypsum LLC; ToughRock®Mold-Guard™ 1/2" Gypsum Ceiling Board: www.gpgypsum.com.
      c. National Gypsum Company; Gold Bond® BRAND High Strength LITE Ceiling Board: www.nationalgypsum.com..
      d. USG Corporation; SHEETROCK® Brand Sag-Resistant Interior Gypsum Ceiling Board

I. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing and soffits, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Unfaced Sheathing: Water-resistant exterior fiber-reinforced gypsum sheathing panels as defined in ASTM C1278/C1278M, and exceeding the relevant requirements of ASTM C1177/C1177M.
5. Core Type: Regular and Type X, as indicated.
6. Type X Thickness: 5/8 inch.
7. Regular Board Thickness: 1/2 inch.
8. Edges: Square.
9. Glass Mat Faced Products:
    a. Continental® Building Products(formelyLafarge North America Inc.): Weather Defense® Platinum Sheathing and Weather Defense® PlatinumSheathing Type X. www.continental-BP.com
    b. Georgia-Pacific Gypsum LLC; DensGlass Gold® Sheathing: www.gpgypsum.com
    c. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com/#sle.
    d. National Gypsum Company; Gold Bond® BRAND e2XP Extended Exposure Sheathing: www.nationalgypsum.com..
    e. United States Gypsum Company ; SECUROCK® Glass-Mat Sheathing Panels: www.usg.com.
    f. Substitutions: See Section 01 6000 - Product Requirements.

J. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Products:
    a. Continental® Buildiing Products(formelyLafarge North America Inc.): Mold Defense® Shaftliner Type X
    b. Georgia-Pacific Gypsum LLC; DensGlass®Ultra Shaftliner (mold-resistant).
    c. National Gypsum Company; Gold Bond® BRAND e2XP® Extended Exposure Shaftliner.
    d. Temple-Inland Inc; GreenGlass®Liner Board
    e. United States Gypsum Company; SHEETROCK® Brand Mold Tough® Gypsum Liner Panels
    f. Substitutions: Not permitted.

K. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C 1396/C 1396M; water-resistant faces.

L. Gypsum Shaftwall or Coreboard: ASTM C 1396/C 1396M; Type X core; sizes to minimize joints in place; 1 inch thick; square, tongue and groove, or double beveled edges, ends square cut.

2.04 FIBERGLASS REINFORCED BOARD MATERIALS

A. Cementitious Backer Board: ANSI A118.9, aggregated portland cement panels with glass fiber mesh embedded in front and back surfaces, 1/2 inch thick.

B. Glass Mat Gypsum Board: Gypsum panels with moisture-resistant core and coated inorganic fiberglass mat back surface designed to resist growth of mold and mildew, per ASTM D 3273.
1. Fiberglass Mat Faced Gypsum Sheathing: Comply with performance requirements of ASTM C 1396/C 1396M for water-resistant gypsum backing board and ASTM C 1177/C 1177M for sheathing; tapered long edges.
    a. Application: Exterior Sheathing
    b. Products :
        1) Glas Roc manufactured by Certainteed: www.certainteed.com.
        2) Dens Glass Gold manufactured by G-P Gypsum: www.gpgypsum.com.com.
        3) Fiber Rock "Aqua Tough" manufactured by United States Gypsum Company: www.usg.com

c. Standard Type: Thickness 1/2 inch.
d. Fire-Resistant Type: Type X core, thickness 5/8 inch.

2.05 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Thickness: Full depth of stud. Locate in partitions as shown on drawings. All acoustically insulated partitions are to extend full height to the underside of the deck.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:
a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
b. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
1) Basis of Design Product: SHEETROCK® Brand Acoustic Sealant manufactured by United States Gypsum Company: www.usg.com.
c. Franklin International, Inc.; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
1. Basis of Design Product: SHEETROCK® Brand Acoustic Sealant manufactured by United States Gypsum Company: www.usg.com.

D. Building Paper: Asphalt impregnated building felt conforming to ASTM D 226, Type I.

E. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
3. Products:
a. Flannery, Inc.: www.flanneryinc.com
b. Gordon Incorporated Interior Specialities:www.gordoninc.com
c. Fry Reglet Corporation,: www.fryreglet.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch wide, coated glass fiber tape for joints and corners at exterior fiberglass mat gypsum sheathing and soffit installations..
2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish at the Contractor's option.
1. Basis of Design Product:
a. [USG Sheetrock® Brand Tuff-Hide™ Primer-Surfacer] manufactured by [USG Corporation].
2. Other Acceptable Manufacturers:
a. PPG SPEEDHIDE® MaxBuild® High Build Drywall Surfacer manufactured by PPG Paints™ www.ppgpaints.com.
b. PRO-HIDE® Silver Interior Latex High Build Primer/Surfacer: manufactured by Pratt & Lambert®: www.prattandlambert.com.

H. Reveal Molding: Extruded aluminum, 1/2" or 5/8" as noted on the Drawings. Fry Reglet, Chicago Metallic, or others. Submit reveal molding type for each condition.
1. Manufacturers: Basis of Design:
a. Fry Reglet Architectural Metals / Drywall Moldings and Trim: www.fryreglet.com.

2. Other Acceptable Manufacturers:
   a. TRIM TEX Drywall Products: www.trimtex.com.
   b. VINYL CORP.™Drywall & Veneer Accessories: www.vinylcorp.com

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

K. Screws: ASTM C 1002; self-piercing tapping type.

L. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

M. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 16 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 16 inches on center.
   1. Orientation: Horizontal.
   2. Spacing: At 16 inches on center.

F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

G. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, wood frame openings, toilet accessories, and hardware. Bolt or screw steel channels to studs per 06 1000.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD AND GLASS MAT FACED BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Provide 5/8" gap between bottom of gypsum board and floor at all partitions. Provide 1/4" caulk joint between gypsum board and door/window frames.

E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Immediately after installation, protect from weather by application of dampproofing, or other acceptable weather barrier.

G. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

H. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

I. Glass Mat Faced Gypsum Board: Install in strict accordance with manufacturer's instructions.

J. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

K. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

L. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: as indicated.
   1. Extend partition control joints to the ceiling structure centered on top of the frame and extend through a bulkhead/soffit condition.
   2. Control joints in ceilings should be located to intersect column penetrations, light fixtures, and air diffusers that can impose stresses on the ceiling.
   3. Place control joints consistent with lines of building spaces and as follows:
      a. Not more than 30 feet apart on walls and ceilings over 30 feet long.
      b. At exterior soffits, not more than 20 feet apart in both directions.
      c. Where a partition, furring or column fireproofing abuts a structural element (except for a floor) or dissimilar wall or ceiling

d. Where a ceiling or soffit abuts a structural elements, dissimilar wall or partition, or other vertical penetration
e. Where construction changes within the plane of the partition or ceiling
f. Where a partition or furring run exceeds 30 feet
g. Where ceiling dimensions exceed 30 feet in either direction with perimeter relief, or 30 feet without relief
h. Where exterior soffits and ceilings exceed 30 feet in either direction
i. Where wings of L, U, and T shaped ceiling areas are joined

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated. J-trim stop not allowed, use L-trim or J-trim 200-A/200-B.

3.07 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
2. Level 2: In utility areas, behind cabinetry, wood veneer paneling and on backing board to receive tile finish.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
4. Level 0: Temporary partitions.

C. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840 and as scheduled below.
1. Above Finished Ceilings Concealed From View: Level 1.
2. Utility Areas and Areas Behind Cabinetry: Level 2.
3. Walls and Ceilings to Receive Flat or Eggshell Paint Finish: Level 4.
4. Walls and Ceilings to Receive Semi-Gloss or Gloss Paint Finish: Level 5.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.
2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
3. Taping, filling, and sanding are not required at base layer of double-layer applications.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 FINISH LEVEL SCHEDULE

A. See partition, details and plans for location and extents as follows:
1. Level 1: Above finished ceilings concealed from view.
2. Level 2: Utility areas and areas behind cabinetry.
3. Level 3: Walls scheduled to receive textured wall finish.

B. Abuse Resistant Board: Provide 4’ high at all stair walls and balustrades adjacent to stairs and landings.

C. See Finish Schedule and Finish Plans for location and extents as follows.

1. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
2. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION 09 2116

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Coated glass mat backer board as tile substrate.

E. Ceramic trim.

F. Non-ceramic trim.

G. Crack Isolation / Waterproofing Membrane

1.02 RELATED REQUIREMENTS

A. Section 03 5400 - SELF LEVELING CEMENT BASED UNDERLAYMENT.

B. Section - Joint Sealers.

C. Section 09 2116 - Gypsum Board Assemblies: Tile backing substrate materials and installation.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
   4. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
   5. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
   6. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   7. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
   8. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
   9. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   10. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
   11. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
   12. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

13. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).
14. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
15. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 1999 (Reaffirmed 2010).
16. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).
17. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
18. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
19. ANSI A118.8 - American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout; 2013.1.
20. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

B. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.

C. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

D. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
1. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).
2. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

E. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

F. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

G. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. Include other affected Contractors and Subcontractors affected by the Work. Prior to Preinstallation Meeting all required submittals shall be reviewed and approved, and the mockup constructed, reviewed and approved.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Minimum size 4'x6', including multiple colors.
   2. Approved mock-up may remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers Basis of Design: See Finish Schedule and finish drawings for manufacturer, size, pattern, color(s) and details.
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: As detailed and in sizes indicated.
   1. Applications: As indicated:
   2. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Brushed stainless steel, profile style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.
   1. Applications: As indicated:
      a. Open edges of wall and floor tile.
      b. Open edges of floor tile.
      c. Transition between floor finishes of different heights.
      d. Thresholds at door openings.
      e. Floor and wall expansion and control joints.
      f. Floor-to-wall joints.
      g. Borders and other trim as indicated on drawings.
   2. Manufacturer: As scheduled and referenced on drawings
      a. Schluter-Systems; Schiene: www.schluter.com/#sle.
      b. Genesis APS International: www.genesis-aps.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4 or ANSI A118.15.
   1. Products: Basis of Design:
      a. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.
   2. Other acceptable setting products

2.04 ADHESIVE MATERIALS

A. Manufacturers:
   1. Bonsal American, Inc: www.sakrete.com
   2. Bostik Inc: www.bostik-us.com.
   3. Mapei Corporation: www.mapei.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.

2.05 MORTAR MATERIALS

A. Manufacturers:
   1. Bostik, Inc: www.bostik-us.com.
   2. Custom Building Products: www.custombuildingproducts.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Mortar Bed Materials: Portland cement, sand, latex additive , and water.

C. Mortar Bond Coat Materials for Thin-Set Installations:
   1. Dry-Set Portland Cement type: ANSI A118.1.
   2. Latex-Portland Cement type: ANSI A118.4.

2.06 GROUTS

A. Manufacturers and Products: Basis of Design
   1. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.

B. Other Acceptable Manufacturers
   1. ARDEX Engineered Cements ARDEX FL™ Rapid Set, Flexible, Sanded Grout : www.ardexamericas.com.
   2. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
   3. Custom Building Products; Product Fusion Pro® Single Component® Grout: www.custombuildingproducts.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.07 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type as specified in Section 07 9200 Joint Sealants.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.
   2. Products:
      a. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Tile Sealer: Stain protection for ceramic tile and natural stone tile.
   1. Products:
      a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com/#sle.
      b. STONETECH, a Division of LATICRETE International, Inc; STONETECH BulletProof Stone Sealer: www.laticrete.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.08 ACCESSORY MATERIALS

A. Concrete Floor Slab Anti Fracture and Waterproofing Membrane: Cold-applied, liquid rubber polymer material complying with ANSI A118.12; with or without
   1. Thickness: 20 mils minimum-40 mils, maximum.
   2. Crack Resistance: No failure at 1/8 inch gap, minimum.
   3. Products:
      a. ARDEX Group© ARDEX 8+9™ :www.ardex.com

B. Cleavage Membrane Under Thick Mortar Bed:
   1. Material: 4 mil thick polyethylene film.

C. Membrane at Walls:
   1. Material: 4 mil thick polyethylene film.

D. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
   1. Product: See Section 09 2116 - Gypsum Board Assemblies .

E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
   1. Standard Type: Thickness 1/2 inch.
   2. Product: See Section 09 2116 - Gypsum Board Assemblies

F. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

F. Install tile backer board in strict accordance with manufacturer's instructions, using galvanized roofing nails or corrosion-resistant bugle head drywall screws. Bed fiberglass self-adhesive tape at all joints and corners with material used to set tiles.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Keep control joints free of adhesive or grout. Apply sealant to joints.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

NOTE: COMBINATION CRACK ISOATION / WATERPROOFING MEMBRANE IS REQUIRED TO BE INSTALLED UNDER ALL AREAS SCHEDULED TO RECEIVE PORCELAIN, CERAMIC, OR OTHER HARD TILE MATERIAL.

NOTE: AT AREAS REQUIRING THE APPLICATION OF CEMENTITIOUS SELF LEVELING UNDERLAYMENT UNDER HARD TILE FLOORING, THE CRACK IAOLATION / WATERPROOFING MEMBRANE SHALL BE INSTALLED OVER THE UNDERLAYMENT.

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

C. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use combination Anti-Fracture and Waterproofiing membrane under all tile unless other underlayment is indicated.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.

B. Cleavage Membrane: Lap edges and ends.

C. Waterproofing Membrane: Install as specified in ANSI A108.13.

D. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

3.09 SCHEDULE (SEE DRAWINGS AND FINISH SCHEDULE)

END OF SECTION 09 3000

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Acoustical insulation.

B. Section 07 9200 - Joint Sealants: Acoustical Sealant.

C. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

I. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

J. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

L. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling, including HVAC Grilles and Diffusers

Lighting, Fire Sprinkler heads, Fire Alarm appliances, Speakers and cameras.

1. Provide details and pertinent information that non ceiling system components described above

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inches square of each product illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.09 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide a minimum of 5% of the amount installed for each type of acoustical unit for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 MANUFACTURERS BASIS OF DESIGN

A. Acoustic Ceiling Tiles/Panels:
   1. Reference Finish Legend and Ceiling Plans on Drawings for Basis of Design Products, Locations and Extents.

2.02 ACCEPTABLE MANUFACTURERS U.N.O.

A. Armstrong World Industries, Inc: www.armstrong.com/#sle.

B. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.

C. Rockfon: www.rockfon.com/#sle.

D. USG Corporation: www.usg.com/ceilings/#sle.

E. Suspension Systems:
   1. Same as for Acoustical Units: Reference on Drawings for locations.

F. Performance Requirements

G. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E84.

2.03 ACOUSTICAL UNITS

A. Manufacturers: Basis of Design:

1. Armstrong World Industries; www.armstrongceilings.com

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).

D. Products: SEE DRAWINGS

2.04 SUSPENSION SYSTEM(S)

A. Manufacturers: Basis of Design **(SAME AS CEILING TILE MFG).**

B. Metal Suspension Systems - General: Complying with 1; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, splices, and gasketing as required.
   1. Materials:
      a. Steel Grid: 1, G90 coating, unless otherwise indicated.
      b. Stainless Steel Grid: ASTM A666, Type 304.
   2. Profile and Finish: As Scheduled.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12-gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: SEE FINISH LEGEND, CEILING PLANS and DETAILS.
   1. Size: As required for installation conditions.
   2. Acoustical Sealant (concealed installation) For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

D. Acoustical Insulation: Specified in Section 07 2100.
   1. Thickness: 2 inches.
   2. Size: To fit acoustical suspension system.

E. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Do not begin Installation until after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension systems in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to the balanced grid design coordinated with field verified, approved shop drawings with consistent size border units no less than 1 /2 of a full acoustical unit.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Miter corners with concealed fasteners. Exposed Pop Rivets are not permitted.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Overlap corners. Use of pop rivets is not permitted.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units according to field use approved shop drawing layouts.

D. Fit border trim neatly against abutting surfaces.

E. Install acoustical units level in uniform plane and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.

I. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 SCHEDULE: SEE FINISH LEGEND ON DRAWINGS

END OF SECTION

SECTION 09 6700

FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete

B. Section 07 9200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

B. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

C. ASTM D905 - Standard Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading; 2008 (Reapproved 2013).

D. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

G. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two samples, 12 x 12 inches in size illustrating color and pattern for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing work of this section with minimum five years experience.

C. Supervisor Qualifications: Trained by product manufacturer, under direct full time supervision of manufacturer's own foreman.

1.06 MOCK-UPS

A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.

1. Number of Mock-Ups to be Prepared: Up to two

2. Use same materials and methods for use in the work.
3. Use approved design samples as basis for mock-ups.
4. Locate where directed.
5. Minimum Size: 48 inches by 48 inches.

B. Obtain approval of mock-up by Architect before proceeding with work.

C. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

1.09 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 PRODUCTS

2.01 FLUID-APPLIED FLOORING SYSTEMS

A. Resinous Flooring: Basis of Design:

1. Elite Crete Systems; Hermetic Stout Flooring – Single Stout Standard: www.elitecrete.com

B. Other Acceptable Manufacturers:

1. Dur-A-Flex, Inc.: www.dur-a-flex.com
2. Sika Corporation: www.sikafloorusa.com
3. Substitutions: See Section 01 6000 - Product Requirements

C. System Characteristics:

1. Color and Pattern: As selected by Architect from Mfg. standards
2. Wearing Surface: Medium
3. Overall System Thickness: 2mm

D. System Components: Manufacturer's standard components that are compatible with each other including vapor barrier, base coat, silica quartz broadcast, body coat, and pigmented protective top coat

2.02 ACCESSORIES

A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

B. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

3.04 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
    a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates

C. Broadcast: Immediately broadcast quartz silica aggregate into the primer using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

D. Body coat: Mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously primed substrate using manufacturer's installation tool. Roll material with strict adherence to manufacturer's installation procedures and coverage rates.

E. Broadcast: Immediately broadcast decorative flakes into the body coat. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

F. First Sealer: Remove excess un-bonded flakes by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

G. Second sealer: Lightly sand first sealer coat. Mix and apply second sealer coat with strict adherence to manufacturer's installation procedures.

3.05 TERMINATIONS

A. Chase edges to “lock” the coating system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

3.06 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints to and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Vertical and horizontal contraction and expansion joints are treated by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.08 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General Contractor is responsible for cleaning prior to inspection.

3.09 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

3.10 SCHEDULE (SEE DRAWINGS)

END OF SECTION 09 6700

SECTION 09 9000

PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.

B. Section 09 9650 - High Performance Coatings-Specialty.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment: Painted identification.

E. Section 26 0553 - Identification for Electrical Systems: Painted identification.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

B. Maintain one copy of relevant portions of MPI Architectural Painting Specification Manual on project site at all times.

C. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints and Coatings: Any manufacturer listed in MPI Approved Products List (at www.paintinfo.com) under applicable MPI product reference number, unless otherwise indicated.

B. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

C. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

D. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
2. Substitution of a different system using MPI-approved products by the same manufacturer will be considered.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.
1. Provide ready mixed paints and coatings, except field-catalyzed coatings.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

C. Where a specified paint system does not have a Custom Grade, provide Premium Grade system.

D. Where sheen is not specified or more than one sheen is specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Provide colors as scheduled on Drawings.

PART 3 EXECUTION

3.01 SCOPE - SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
7. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
a. Refer to Section 22 0553 and Section for schedule of color coding of equipment, duct work, piping, and conduit.

8. Paint all mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.
9. Paint shop-primed mechanical and electrical items occurring in finished areas.
10. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
11. Paint interior surfaces of air ducts and convector and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
12. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
13. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

C. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
2. Items indicated to receive other finish.
3. Items indicated to remain naturally finished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Anodized aluminum.
6. Polished and brushed stainless steel items.
7. Brick, precast concrete, integrally colored plaster.
8. Acoustical materials.
9. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Board: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors: 8 percent.

E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
1. Report results in writing to Architect before starting work.
2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
   1. Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in MPI Manual. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present.
   4. Etch concrete as specified in MPI Manual.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

K. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

L. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

M. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
   1. Test coat anodized treatments with primer as recommended by anodized treatment manufacturer; if manufacturer can not be reasonably found, test per industry standards.

N. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
   1. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.

O. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by

washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

1. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

P. Shop-Primed Steel Surfaces to be Finish Painted: 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. Re-prime entire shop-primed item.

Q. Interior Wood Items to Receive Opaque 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. Back prime concealed surfaces before installation.

R. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. 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. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

S. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

T. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

U. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces (6) with clear sealer.

V. Metal Doors to be Painted: Prime metal door top, sides and bottom edge surfaces (6).

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Provide completed work matching approved samples for color, texture, and coverage.
   2. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
   1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
   2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
   4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.
   2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
7. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.
8. Stippled Finish: Roll and redistribute paint to even, fine texture; leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections; back roll final coat to achieve a uniform surface.

F. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.06 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

3.07 SCHEDULE - COLORS (SEE DRAWINGS)

END OF SECTION 09 9000

SECTION 09 9650

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes applying special coating systems to items and surfaces scheduled, including surface preparation, prime coats, and topcoats for interior and exterior painting.

B. High performance coatings intended for finishing various metal elements and components and finish coating new Architectural Exposed Steel construction.

C. High performance coatings intended for interior overhead painting of carbon and galvanized steel, aluminum, wood, concrete, concrete decks, beams, joists, and HVAC components.

D. High performance coatings intended for coating new concrete masonry.

E. Special preparation of surfaces.

F. Section also includes surface preparation and application of high-performance coating systems on the following substrates:

1. Cast in Place Concrete
2. Exterior Substrates:
    a. Galvanized steel bollards.
    b. Miscellaneous steel shapes.
3. Interior Substrates:
    a. Cast in place concrete.
4. Galvanized Steel
5. Unprimed Steel
6. Sprayed cellulose acoustical finish system.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 1000 - Structural Steel: Shop priming of steel with primers specified in this section.

C. Section 05 5000 - Metal Fabrications : Unprimed and Galvanized Steel

D. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. ASTM B 117 Standard Test Method for Corrosion Resistance.

B. ASTM D 2240 Standard Test Method for Measuring Shore Hardness.

C. ASTM D 2794 Standard Test Method for Measuring Direct Impact.

D. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.

E. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.

F. ASTM D 4060 Standard Test Method for Abrasion Resistance.

G. ASTM D 4213 Standard Test Method for Measuring Scrub-ability of Coatings.

H. ASTM D 4258 Standard Practice for Surface Cleaning Concrete for Coating.

I. ASTM D 4259 Standard Practice for Abrading Concrete.

J. ASTM D 4261 Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.

K. ASTM D 4263 Standard Test Method for Indicating Moisture by the Plastic Sheet Method.

L. ASTM D 4541 Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

M. Steel Structures Painting Council Surface Preparation Specifications (SSPC-SP)

N. Steel Structures Painting Council Paint Application Specifications (SSPC-PA)

1.04 DEFINITIONS

A. Definitions as used in Finish Schedule shown on Drawings and Coating Schedule included herein.

B. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.

C. Normal: Surfaces subject to normal temperature and humidity.

D. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, the first coat is the finish coat.

E. Second, Third, Intermediate, or Finish coats: Successive finish coats applied over first coat.

F. DFT: Dry Film Thickness (Mils/coat).

G. Sfpg: Square feet per gallon (per coat).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1. Conference shall be attended by the Contractor, Owner's representative, Architect, coating applicators, and a representative of coating material manufacturer.

2. Topics to be discussed at the meeting shall include:

3. A review of Contract Documents and accepted shop drawings shall be made, and deviations or differences shall be resolved.

4. Review items such as environmental conditions, surface conditions, surface preparation, application procedures, and protection following application. A surface mock-up of the surface preparation requirements for the project, both interior and exterior, shall be prepared by the Contractor. All parties shall agree to the degree of cleanliness and the mock-up shall be preserved for the duration of the project.

5. Establish which areas on-site will be available for use as storage areas and working area.

C. Pre-construction conference and inspection shall serve to clarify Contract Documents, application requirements and what work should be completed before coating application can begin.

D. Prepare and submit to parties in attendance, a written report of pre-installation conference. The report shall be submitted within 3 days of the conference.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, and installation instructions.

1. To be considered for approval all submittals shall include the following: Manufacturer's product data sheets, product performance criteria, generic chemistry of each coating, and application recommendations for each coating scheduled.

2. List each material and cross-reference the specific coating, finish system, and application.

C. Submit one copy of the manufacturer’s Material Safety Data Sheets (MSDS) for each type of coating. Contractor shall post a copy of MSDS on the Site at all times when coating is in progress.

D. Installation Instructions: Manufacturer’s written installation instructions for the materials specified in this Section.

E. Qualification Data: Submit proof of acceptability of Applicator by manufacturer to Architect/Owner.

F. Jobsite Reports: Submit at the completion of Work.

G. Daily Reports: Include surface preparation, ambient conditions, application methods, material applied, material quantities, material batch number, and description of items completed.

H. The applicator shall maintain a copy of records until the expiration of the specified warranty period.

I. Construction Details: Copies of manufacturer’s computer-generated standard lining details for specified materials, including leading edge termination, metal embedment in concrete, joint detail, wall-to-slab detail, pipe termination detail, and any other detail at the request of the Architect.

J. Color Selection: One complete set of color chips representing manufacturer's full range of available colors.

K. For each color selected submit two samples, minimum size 3 X 6-inch square.

L. Operation and maintenance data for each of the coating systems.

M. Shop Drawings: Submit a complete list of products proposed for use, including identifying product names and catalog numbers.

1. Arrange in same format as Schedule of Finished

2. Include applicable manufacturer’s data and recommendations.

N. Manufacturer’s Certificates: Provide a letter certifying products specified meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

1. Materials shall be products of a single manufacturer or items standard with manufacture of specified coating materials.

2. Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

B. Applicator Qualifications: Company approved by the manufacturer, specializing in performing work of the type specified and with at least five years of documented experience.

C. Testing Agency Qualifications: Independent testing agency with documented experience in conducting tests of the type specified.

D. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. Apply a 100 square foot representative sample to be reviewed by the Architect and/or Owner prior to proceeding.

1. Refinish mock-up area as required to produce acceptable work.

2. Retain mock-ups to establish intended standards by which coating systems will be judged.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

B. Store in area protected from exposure to weather and vandalism.

C. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.

D. Oily rags and waste must be removed from buildings each night or kept in appropriate metal

containers. Provide fire extinguishers of the type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

E. Empty containers shall have labels canceled and clearly marked as to use.

F. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.09 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 the manufacturer's absolute limits.

B. Weather:

1. Air and surface temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above the dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's recommended limit.

C. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

D. Dust and Conditions:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Coating manufacturer shall warranty its products as free from material defects for a minimum period of five (5) years, from date of conditional acceptance. Provide associated warranty certificate.

C. Applicator's Warranty: Applicator shall warranty the installed protective coating system as free from material and workmanship defects for a minimum period of two (2) years. Provide associated warranty certificate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High Performance Coatings Basis of Design
1. Tnemec Company, Inc: www.tnemec.com

B. Other Acceptable Manufacturers
1. Substitutions: See Section 01 6000 - Product Requirements.
2. Only coatings that meet or exceed the performance of these specified coatings may be submitted for use. No substitutions will be considered that change the generic chemistry of the coatings specified.
3. The decision of the Architect/Owner regarding approval or disapproval of the proposed substitution shall be final.

2.02 MATERIALS

A. Color shall be formed of pigments free of lead, lead compounds, or other materials that might be

affected by the presence of hydrogen sulfide or other gases likely to be present at the Site.

B. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations.

C. Mix in accordance with the manufacturer's recommendations.

D. Source Quality: Obtain painting, coating, and thinning materials from a single manufacturer.

E. Materials Compatibility:

1. Provided materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.

B. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the timely and proper completion of the work. Materials removed and replaced to correct defects due to errant application such as overspray or drips on unsuitable surfaces shall be at the Contractor's expense.

3.02 PREPARATION

A. General:

1. All surfaces to be coated shall be prepared as specified herein and in accordance with the coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
2. Quality of surface preparation described herein is considered a minimum. If the coating manufacturer requires a higher degree of preparation, comply with the coating manufacturer's recommendations.
3. Surfaces shall be prepared in accordance with the manufacturer’s written instructions as outlined in the product data sheet and application guides.
   a. Surface preparation shall be as specified in the designated coating system.
4. Clean Substrates of Substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints.
   a. Remove incompatible primers and re-prime substrate with compatible primers of apple tie coat as required to produce coating systems indicated.
5. Where surface dryness is questioned, test with a dampness-indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by the coating manufacturer.

B. Ferrous Metal:

1. New Steel: Prior to surface preparation all ferrous metals shall be cleaned of oil, grease and other contaminants in accordance with SSPC-SP 1 Solvent Cleaning. All surfaces shall be abrasive blast cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. Surface profile shall be 1.5 – 2.5 mils.
2. Workmanship for surface preparation shall conform to the following Steel Structures Painting Council (SSPC) specification:
   a. Solvent Cleaning: SSPC-SP1
   b. Hand Tool Cleaning: SSPC-SP2
   c. Power Tool Cleaning: SSPC-SP3
   d. White Metal Blast Cleaning: SSPC-SP5
   e. Commercial Blast Cleaning: SSPC-SP6
   f. Brush-Off Blast Cleaning: SSPC-SP7

g. Near-White Blast Cleaning: SSPC-SP10
h. Power Tool to Bare Metal Cleaning: SSPC-SP11
i. High Pressure Water Jetting: SSPC-SP12

C. Concrete and Masonry Substrates:
1. All surfaces must be clean, dry, and free of oil, grease, and other contaminants, prior to preparation in accordance with NACE No. 6/SSPC-SP13. Concrete surfaces must be sound and capable of supporting the coating system.
2. Cracks, voids, and other surface imperfections should be filled with the recommended filler or surfacer prior to the installation of the materials.
3. Level or grind concrete substrates to produce a uniform and smooth surface, including removal of sharp edges, ridges, form fins, and other concrete protrusions.
4. All surfaces to be painted or repainted shall be repaired, cleaned, and finished to the standards as specified herein and in Division 3 for new concrete.

3.03 APPLICATION

A. Apply coatings in accordance with manufacture's written instructions as outlined in the product data sheet, application guides and technical bulletins.

B. The application of coatings to steel substrates shall be in accordance with SSPC PA1 - Shop, Field, and Maintenance Painting of Steel.

C. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

D. Uniformly apply coatings at spreading rate required to achieve specified Dry Film Thickness (DFT).

E. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

F. Surfaces shall be dry at the time of application.

G. The minimum surface temperature shall be 50 degrees F and rising unless noted otherwise.

H. Apply in strict accordance with the manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.

I. Each coat shall be allowed to dry in accordance with the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions." Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.

J. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison to adjoining surfaces.

K. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.

L. Crevices and other hard to apply areas shall be back-rolled/back-brushed in conjunction with the field-applied prime coat.

M. Where multiple coats of the same material are applied, each undercoat shall be slightly different in shade to facilitate identifying each coat.

3.04 FIELD QUALITY CONTROL, INSPECTION AND TESTING

A. The Applicator shall perform the quality control procedures listed below in conjunction with the requirements of this section.

B. Inspect materials upon receipt to ensure that products are supplied by the approved Manufacturer.

C. Surface Cleanliness: Prepared surfaces shall be inspected for surface cleanliness after cleaning and drying, prior to the coating application.

D. Measure and record ambient air temperature, relative humidity, and dew point temperature once every two hours of each work shift to ensure that the products are being applied within the manufacturer's recommendations.

E. Measure and record substrate temperature once every two hours using an infrared or other surface thermometer to ensure that the products are being applied within the manufacturer's recommendations.

F. Film Thickness:
   1. Wet-Film Thickness shall be taken every 100 square feet in accordance with ASTM D4414 or other agreed-upon method.

G. The applicator is responsible for keeping the Engineer informed of progress so that Engineer may provide additional quality control at his discretion.

H. Inspection by the Engineer or others does not absolve the applicator from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

I. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for technical assistance and guidance for surface preparation and application of coating system.

3.05 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where the result is not visibly different from adjacent surfaces. Recoat the entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 CLEANING AND PROTECTION

A. Protect the completed Work from traffic, physical abuse, immersion, and chemical exposure until the complete system has thoroughly cured as per manufacturer's written instructions.

B. At the completion of the Work, Applicator shall remove materials and debris associated with the Work of this Section.

C. Clean surfaces not designated to receive coating. Restore designated areas in a manner acceptable to Engineer.

D. Protect the completed Work from damage until Final Acceptance. Coating damaged in any manner shall be repaired or replaced at the discretion of Engineer, at no additional cost to Owner.

3.07 TWO-YEAR INSPECTION

A. Owner will set date for two-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair defects in the coating systems as determined by Architect in accordance with manufacturer's instructions.

3.08 COATING SYSTEMS

A. Scheduled thickness or coverage rate is the minimum as recommended by Tnemec Company, Inc. If another manufacturer is used, the manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.

B. Coatings shall conform to the following schedule and coating manufacturer's recommendations. Examples of surfaces to be coated may not be all inclusive.

C. Ferrous structural steel shall be shop-primed. Field touch-up, where necessary, shall consist of surface preparation equivalent to what is specified and application of each coat that is in need of repair.

3.09 COATING SCHEDULE

A. **Interior Exposed Steel: Field Applied System**

1. Surface Preparation: Provide a uniform, clean, and dry surface free of form release agents, bond-breakers, and all other foreign contaminants prior to application of coatings. SSPC-SP 1.
2. 1st Coat: Series 138 ProTuff
3. Dry Film Thickness: 4.0 - 6.0 mils
4. 2nd Coat: Series 138 ProTuff
5. Dry Film Thickness: 4.0 - 6.0 mils
6. Total Dry Film Thickness: 8.0 Minimum
7. System Requirements:
   a. Generic Chemistry: Exterior Durable, Self-Crosslinking Hydrophobic Acrylic Dryfall with flash-rust and corrosion inhibitors. For use on concrete, steel, and galvanized.
   b. Sheen: Eggshell

B. **Exposed Structural and Architecturally Exposed Ferrous Metals (Exterior):**

1. Shop Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning
2. Shop Primer: Tnemec Series 90-97 Tneme-Zinc applied at a rate to achieve 2.5 – 3.5 mils dry film thickness. Prime coat shall meet the following performance criteria:
   a. Generic Type: Organic Zinc Rich Urethane Primer
   b. Solids By Volume: 63%
   c. Zinc Content: 83% by weight. ASTM D520 Type III Zinc Dust
   d. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.
   e. Adhesion: ASTM 4541 Elcometer Adhesion.
   f. Humidity: ASTM D 4585. 4,000 hours exposure.
   g. Cathodic Disbondment: ASTM G8, Method A. Days Exposure
   h. Immersion: ASTM D 870 Potable Water Immersion. 7 years immersion.
   i. Prohesion: ASTM G 85 Prohesion Cabinet. 15,000 hours exposure.
3. Field Touch-Up/Repair Surface Preparation: Shop applied primer damaged during shipping and erection shall be cleaned in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. All edges shall be feathered. All surfaces shall be clean, dry and in a suitable condition to be coated.
4. Touch-Up/Repair Primer: Tnemec Series 90-97 Tneme-Zinc applied at a rate to achieve 2.5 – 3.5 mils dry film thickness. Prime coat shall meet the following performance criteria:
   a. Generic Type: Organic Zinc Rich Urethane Primer
   b. Solids By Volume: 63%
   c. Zinc Content: 83% by weight. ASTM D520 Type III Zinc Dust
   d. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.
   e. Adhesion: ASTM 4541 Elcometer Adhesion.
   f. Humidity: ASTM D 4585. 4,000 hours exposure.
   g. Cathodic Disbondment: ASTM G8, Method A. Days Exposure
   h. Immersion: ASTM D 870 Potable Water Immersion. 7 years immersion.
   i. Prohesion: ASTM G 85 Prohesion Cabinet. 15,000 hours exposure.
5. Intermediate Coat: Tnemec Series 66 Hi Build Epoxoline applied at a rate to achieve 4.0 – 6.0 mils dry film thickness. Intermediate coat shall meet the following performance criteria:
   a. Generic Type: Polyamide Epoxy
   b. Solids By Volume: 56%.
   c. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe

and blistering).

d. Immersion: ASTM D 870. 7 Years.
e. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
f. Adhesion: ASTM 4541 Elcometer Adhesion.
g. Humidity: ASTM D 4585. 4,500 hours

6. Finish: Tnemec 1072 Fluoronar applied at a rate to achieve 2.0 – 3.0 mils dry film thickness. Finish coat shall the following performance criteria:
   a. Generic Type: Thermoset Fluoropolymer Polyurethane
   b. Solids By Volume: 60%.
   c. Salt Spray (Fog): ASTM B 117, 10,000 hours exposure
   d. Adhesion: ASTM 4541 Elcometer Adhesion.
   e. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
   f. Flexibility: ASTM D 522 (Method A)
   g. Hardness: ASTM 3363.
   h. Humidity: ASTM 4585, 3,000 hours exposure
   i. Impact: ASTM D 2794
   j. QUV: ASTM D 4587, 16,000 hours exposure.
   k. QUV: ASTM D 4587, 25,000 hours exposure.
   l. Exterior Exposure: ASTM D 4141, Method C (EMMAQUA), 1,500 MJ/m² Exposure. Report gloss retention and color retention.
   m. Exterior Exposure: ASTM D 4141, Method C (EMMAQUA), 2,000 MJ/m² Exposure. Report gloss retention and color retention.
   n. Exterior Exposure: ASTM D 4141, Method C (EMMAQUA), 5,000 MJ/m² Exposure. Report gloss retention and color retention.
   o. AAMA 2605 (10 Years South Florida Exposure)

END OF SECTION

SECTION 09 6623

RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thin-set, epoxy-resin terrazzo flooring.
2. Precast epoxy-resin terrazzo units.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.
2. Section 096723 "Resinous Flooring" for decorative resinous flooring systems applied as self-leveling slurries or as troweled or screeded mortars.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
2. Control-joint strips.
3. Accessory strips.
4. Abrasive strips.
5. Stair treads, risers, and landings.
6. Precast terrazzo jointing and edge configurations.
7. Terrazzo patterns.
8. <**Insert requirements**>.

C. Samples: For each exposed product and for each color and texture specified, [**6 inches (150 mm)**]<**Insert dimension**> in size.

D. Samples for Initial Selection: NTMA's "Terrazzo Color Palette" showing the full range of colors and

patterns available for each terrazzo type.

E. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: [**6-inch- (150-mm-)**]<**Insert dimension**> square Samples.
2. Precast Terrazzo: [**6-inch- (150-mm-)**]<**Insert dimension**> square Samples.
3. Accessories: [**6-inch- (150-mm-)**]<**Insert dimension**> long Samples of each exposed strip item required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of terrazzo material or product.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Preinstallation moisture-testing reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage an installer who is a contractor member of NTMA.
2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for terrazzo including accessories.

   a. Size: Minimum **100 sq. ft. (9 sq. m)** of typical poured-in-place flooring[**and base**] condition for each color and pattern in locations directed by Architect.
   b. Include [**base**][**first three stair treads**]<**Insert item**>.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or

manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations, General: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo (Insert designation): Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.

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. Crossfield Products Corp

b. Master Terrazzo Technologies LLC
c. Terrazzco Brand; Concord Terrazzo Company, Inc.
d. Terrazzo & Marble Supply Companies

B. Mix Color and Pattern: Match Architect's sample..

C. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D412.

a. Reinforcement: Fiberglass scrim.

3. Primer: Manufacturer's product recommended for substrate and use indicated.
4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

a. Physical Properties without Aggregates:

1) Hardness: 60 to 85 per ASTM D2240, Shore D.
2) Minimum Tensile Strength: **3000 psi (20.7 MPa)** per ASTM D638 for a **2-inch (51-mm)** specimen made using a "C" die per ASTM D412.
3) Minimum Compressive Strength: **10,000 psi (6.9 MPa)** per ASTM D695, Specimen B cylinder.
4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.

a) Distilled water.
b) 1.0 percent soap solution.

b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a **1/4-inch (6.35-mm)** nominal thickness, and cured for 7 days at **75 deg F (24 deg C)** plus or minus **2 deg F (1 deg C)** and at 50 percent plus or minus 2 percent relative humidity.

1) Flammability: Self-extinguishing, maximum extent of burning **1/4 inch (6.35 mm)** according to ASTM D635.
2) Thermal Coefficient of Linear Expansion: **0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C)** according to ASTM C531.

5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.

6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled

content not less than <**50% (fifty)**> percent.

7. Finishing Grout: Resin based.

2.4 PRECAST EPOXY-RESIN TERRAZZO

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. Precast Terrazzo Enterprises, Inc
2. Romoco Precast Terrazzo Products; a subsidiary of Roman Mosaic & Tile Company

B. Precast Terrazzo Base <**Insert designation**>: Minimum **3/8-inch- (18-mm-)** thick, epoxy terrazzo units cast in maximum lengths possible, but not less than **36 inches (900 mm)**. Comply with manufacturer's written instructions for fabricating precast terrazzo base units in sizes and profiles indicated.

1. Type: As indicated Coved with minimum 3/4-inch (19-mm) radius.
2. Top Edge: Radius edge with polished top surface.
3. Metal Toe Strip: Zinc.
4. Outside Corner Units: With finished returned edges at outside corner.
5. Color, Pattern, and Finish: Match adjacent poured-in-place terrazzo flooring.

C. Precast Terrazzo Units <**Insert designation**>: Minimum 3/4-inch (19-mm) thick, epoxy terrazzo units. Comply with manufacturer's written instructions for fabricating precast units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to **1/8-inch (3.2-mm)** radius.

1. Color, Pattern, and Finish: Match adjacent poured-in-place terrazzo flooring.

2.5 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Material: Aluminum.
2. Top Width: 1/8 inch (3.2 mm).

B. Heavy-Top Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Bottom-Section Material: Matching top-section material.
2. Top-Section Material: Aluminum.
3. Top-Section Width: 1/8 inch (3.2 mm).

C. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

D. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.
3. Nosings for terrazzo stair treads and landings.

4. <**Insert requirements**>.

E. Abrasive Strips: Three-line Two-line abrasive inserts at nosings. Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.

1. Width: 1/2 inch (12.7 mm).
2. Depth: As required by terrazzo thickness.
3. Length: 4 inches (100 mm) less than stair width.
4. Color: Match adjacent Terrazzo surfaces..

2.6 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer Chemical-resistant epoxy.

1. Surface Friction: Not less than 0.6 according to ASTM D2047.
2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

    a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
    c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

D. Preinstallation Moisture Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Moisture Testing: Perform tests so that each test area does not exceed [**200 sq. ft. (18.6 sq. m)**]<**Insert area**>, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours when tested according to ASTM F1869 using anhydrous calcium chloride.
    b. Relative Humidity Test: Maximum [**75**]<**Insert number**> percent relative humidity measurement when tested according to ASTM F2170 using in-situ probes.

3. Proceed with terrazzo installation only after concrete substrates pass moisture testing.[**or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing**].

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install on concrete substrates that incorporate lightweight aggregates.
2. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane to produce full substrate coverage in areas to receive terrazzo..
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during

installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Strip Materials:

1. Divider and Control-Joint Strips:

   a. Locate divider strips .
   b. Install control-joint strips back to back and directly above concrete-slab control joints.
   c. Install control-joint strips with [**1/4-inch (6.4-mm)**]<**Insert dimension**> gap between strips, and install sealant in space.
   d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation.
3. Abrasive Strips: Install with surface of abrasive strip positioned [**1/16 inch (1.6 mm)**]<**Insert dimension**> higher than terrazzo surface.

C. Apply primer to terrazzo substrates according to manufacturer's written instructions.

D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.

1. Installed Thickness: 3/8 inch (9.5 mm) nominal.
2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

   a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.
   b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.
   c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 120-grit stones or with comparable diamond abrasives until grout is removed from surface.

3. Installation Tolerance: Limit variation in terrazzo surface from level to 3/16 inch in 10 feet 5 mm in 3 m.; noncumulative.

E. Install and finish poured-in-place terrazzo base at the same time the adjacent terrazzo flooring is installed.

3.4 PRECAST TERRAZZO INSTALLATION

A. Install precast terrazzo units using method recommended in writing by NTMA and manufacturer unless otherwise indicated.

B. Do not install units that are chipped, cracked, discolored, or improperly finished.

C. Seal joints between units with Non shrink, structural joint compound matching terrazzo mix..

3.5 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.6 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is maintained without damage or deterioration until time of Substantial Completion and acceptance.

END OF SECTION 09 6623

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and Door Identification.

B. Interior directional and wayfinding.

C. Exterior mounted Building identification signage.

D. Vinyl applied signage.

E. HDPL Faced Custom Shapes.

1.02 RELATED REQUIREMENTS

A. Section 01 3100 - Project Management and Coordination.

B. Section 01 1700 - Execution Requirements.

C. Section 06 2000 - Finish Carpentry

D. Section 06 4100 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

H. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 2017, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every opening, whether it has a door or not, except corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1-1/2 inch, or as required to comply with requirements.
   4. Sign Height: 3 inches, or as required to comply with requirements.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Service Rooms and utility rooms: Identify with room names only.
   7. Rest Rooms: Identify with pictograms, text reading "MEN" and "WOMEN", and braille.

C. Interior Wayfinding and Informational Signs:
   1. Sign Type: Same as room and door signs.

D. Building Identification Signs:
   1. Use individual metal letters as follows:
      a. Size as noted in Drawings, pin mounted, laser cut, aluminum letters, fabricated of
         1) Material: Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by signage producer and finisher for type of use and finish indicated, with minimum stiffness and durability properties of 6063 alloy -T5 Temper.
         2) Finish: Class I Color Anodized.
         3) Letter Font: See Drawings.
   2. Mount as located on drawings.

2.02 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

C. Color and Font: Unless otherwise indicated:
   1. Character Font: See Drawings.
   2. Character Case: As indicated.
   3. Background Color: As selected.
   4. Character Color: Contrasting color as selected.

2.03 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/8 inch.

B. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.

1. Total Thickness: 1/8 inch.

C. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
1. Total Thickness: 1/8 inch.
2. Letter Thickness: 1/8 inch.
3. Letter Edges: Radiused.

2.04 DIMENSIONAL LETTERS

A. Interior Metal Letters:
1. Mounting: Tape adhesive.

2.05 VINYL SIGNAGE

A. Provide sign made of cut vinyl graphic film applied directly to mounting surface (glass, smooth wall, doors, etc.).
B. Material & Colors:
C. Opaque & Translucent: To be constructed of high performance cast vinyl graphic film products such as 3M Scotchcal or equal with a 5 year or greater warranty.
D. Frosted Glass Effect: To be constructed of 3M Scotchcal ElectroCut Graphic Film Frosted Crystal, 7725SE-324.
E. All lettering must be computer cut from professional quality artwork. No hand cut vinyl film shall be installed.
F. Signs shall be cut from sufficiently large rolls of material to minimize seams or joining of material to create one sign.
G. Signs shall be provided in the sizes & quantities indicated on the shop drawings.
H. Installation method:
I. Signs shall be installed free of bubbles, wrinkles or other anomalies.
J. Provide signs as either front applied (first surface) or reverse applied (second surface) as required.

2.06 HDPL FACED CUSTOM SHAPES

A. Provide custom signage as shown on Drawings.
B. Material and Colors:
1. See Section 06 4100 for laminate material manufacturers.
2. See Section 06 2000 for Sheet Materials.
3. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
4. 1/4" metal trim on all exposed sides, powdercoated; color: TBD
C. Fabrication:
1. CNC Routed; no hand cut material shall be installed.
D. Installation method:
1. Direct attached to wall; concealed fasteners.

2.07 ACCESSORIES

A. Concealed Screws: Stainless steel, Aluminum or other non-ferrous metal.
B. Exposed Screws: Stainless steel.
1. Metal: Aluminum casting.
C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install neatly, with horizontal edges level.
C. Locate signs where indicated on attached schedule and as required by ADA Standards:
D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION 10 1400

SECTION 10 2100

PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Concealed steel support members.

B. Section 05 5000 - Metal Fabrications: Concealed steel support members.

C. Section 06 1000 - Rough Carpentry: Blocking and supports.

D. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coord. the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Samples: Submit two samples of partition panels, 3_by_3 inch (.118_by_.118 mm) in size illustrating panel finish, color, and sheen.

D. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments - Basis of Design:
   1 Scranton Products; Eclipse Partitions: www.scrantonproducts.com

B. Other Acceptable Manufacturers:
   1 Inpro; www.inrpcorp.com
   2 Metpar Corp; www.metpar.com
   3 Substitutions: Section 01 6000 - Product Requirements

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
   1 Color: As indicated on drawings.
   2 Doors:
      a. Thickness: 1 inch (25 mm).
      b. Width: 24 inch (610 mm).
      c. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
      d. Height: 55 inch (1397 mm).

3 Panels:
a. Thickness: 1 inch (25 mm).
b. Height: 55 inch (1397 mm).
4 Pilasters:
a. Thickness: 1 inch (25 mm).
b. Width: As required to fit space; minimum 3 inch (76 mm).
5 Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.03 COMPONENTS

A. Toilet Compartments: Solid molded plastic panels, doors, and pilasters, floor-mounted headrail-braced.
1 Color: As indicated on drawings.

2.04 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.

B. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

D. Hinges: Stainless steel, manufacturer's standard finish.
1 Continuous-type hinge, self closing.

E. Door Hardware: Stainless steel, manufacturer's standard finish.
1 Door Latch: Slide type with exterior emergency access feature.

F. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vert. edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Accessories for toilet rooms and utility rooms.
   1. Contractor provided and installed.

C. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

B. Section 06 1000 - Rough Carpentry: Material for and placement of concealed blocking.

C. Section 09 3000 - Tiling: Ceramic washroom accessories.

D. Section 10 2113.19 - Solid Phenolic Plastic Toilet Partitions.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

E. ASTM C1036 - Standard Specification for Flat Glass; 2011.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

G. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3100 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: See Schedule on Drawings for manufacturer and responsibility.

B. Commercial Toilet, Shower, and Bath Accessories:
   1. Bobrick: www.bobrick.com
   2. ASI - American Specialties, Inc: www.americanspecialties.com.

3. Bradley Corporation: www.bradleycorp.com.
4. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide three keys for each accessory to Owner; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

D. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

A. All accessories to be Contractor provided and installed.

B. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: As indicated on Drawings.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Fixed Tilt Mirrors: Minimum 3 inches tilt from top to bottom.

C. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

2.05 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Three spring-loaded rubber cam holders.
   2. Length: 36 inches.
   3. Length: Manufacturer's standard length for number of holders.

B. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.
   5. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06100 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by Accessibility Standards ICC / ANSI A117.1.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 2800

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 9123 - Interior Painting: Field paint finish.

C. Section 21 1200 - Fire-Suppression Standpipes: Cabinet enclosure for extinguishers.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Amerex Corporation: www.amerex-fire.com
   2. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Amerex Corporation; Product #A 441: www.amerex-fire.com
   2. JL Industries, Inc: www.jlindustries.com.
   3. Larsen's Manufacturing Co: www.larsensmfg.com.
   4. Potter-Roemer: www.potterroemer.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, red color.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

C. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Class ABC.
   2. Size 10.
   3. Finish: Baked enamel, Red color.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.

B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

C. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Fabrication: Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door:
   1. General locations: No.4 - Brushed stainless steel.
   2. Indoor Pool Area: #180 Clear Satin Anodized

G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: Owner's standard flag type wall sign.

C. Cabinet Graphic: "FIRE EXTINGUISHER"
   1. Red Lettering vertical on glazed panel of cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, dimensioned from finished floor to handle of cabinet door in accordance with ADA ABA Accessibility Guidelines, chapter 308.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

3.03 SCHEDULES SEE LIFE SAFETY PLANS FOR LOCATIONS.

END OF SECTION 10 4400

SECTION 10 7527

FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ground-mounted flagpoles made from aluminum.

B. Owner-Furnished Material: Flag[**s**].

C. Related Sections:
1. Division 16 Section "Exterior Lighting" for site lighting fixtures.

PERFORMANCE REQUIREMENTS

D. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Seismic Loads: according to SEI/ASCE 7.
2. Wind Loads: according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
3. Base flagpole design on cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

1. Include section, and details of foundation system for ground-mounted flagpoles.

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

D. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

E. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. American Flagpole; a Kearney-National Inc. company.
2. Atlantic Fiberglass Products, Inc.
3. Baartol Company.
4. Concord Industries, Inc.
5. Eder Flag Manufacturing Company, Inc.
6. Ewing Flagpoles.
7. Lingo Inc.; Acme Flagpole Company Division.
8. Millerbernd Manufacturing Company.
9. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
10. PLP Composite Technologies, Inc.
11. Pole-Tech Company Inc.
12. U.S. Flag & Flagpole Supply, LP.
13. USS Manufacturing Inc.

2.2 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
3. Provide self-aligning, snug-fitting joints.

B. Exposed Height: 40 feet

C. Aluminum Flagpoles: Provide entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- (1.6-mm-) nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

1. Provide flashing collar of same material and finish as flagpole.
2. Provide steel ground protectors extending 12 inches (300 mm) aboveground

E. Sleeve for Aluminum Flagpole: Fiberglass foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Provide flashing collar of same material and finish as flagpole.

F. Cast-Metal Shoe Base: For anchor-bolt mounting; provide with anchor bolts.

1. Provide units made from aluminum with same finish and color as flagpoles.
2. Provide ground spike at grade-mounted flagpoles.
3. Provide connector to building's lightning protection system conductor at roof-mounted flagpoles.

G. Hinged Baseplate: Cast-metal tilting hinged base and anchored plate joined by permanently secured pivot rod. Provide with stainless-steel screws for securing tilting base to anchored plate when not tilted; provide with anchor bolts.

1. Finish base to match flagpole.
2. Provide aluminum base or aluminum flashing collar finished to match flagpole.
3. Provide ground spike at grade-mounted flagpoles.
4. Provide connector to building's lightning protection system conductor at roof-mounted metal flagpoles.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch (1.6-mm) spun aluminum[**,** with gold anodic finish.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.

a. Provide with neoprene or vinyl covers.

2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo.

C. Internal Halyard, Cam Cleat System: 5/16-inch- (8-mm-) diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.

a. Provide with neoprene or vinyl covers.

2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo.

2.4 MISCELLANIOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C 33, fine aggregate.

D. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Clear Anodic Finish: AAMA 611, or thicker.

C. Gold Anodic Finish: AAMA 611, AA-M32C22A43 Class I, 0.018 mm or thicker; gold color.

D. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As indicated by manufacturer's designations.

2.7 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

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

2.8 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Division 3 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

2.9 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure. Install flagpole, plumb, in foundation tube].

1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts

and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION

SECTION 12 3600

COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

G. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

H. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.

I. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

J. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

L. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.

M. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

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. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Installation Instructions: Manufacturer's installation instructions and recommendations.

H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in manufacturing each different product specified in this section with minimum ten years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Formica Corporation: www.formica.com/#sle.
         2) Lamin-Art, Inc: www.laminart.com/#sle.
         3) Panolam Industries International, Inc: www.panolam.com/#sle.
         4) Wilsonart: www.wilsonart.com/#sle.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. NSF approved for food contact.
      d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      e. Laminate Core Color: Same as decorative surface.
      f. Finish: As scheduled.
      g. Surface Color and Pattern: As indicated on drawings.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   3. Color: As indicated on drawings.
   4. Back and End Splashes: Same material, same construction.

C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
         2) Dupont: www.corian.com/#sle.
         3) Wilsonart: www.wilsonart.com/#sle.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. NSF approved for food contact.

d. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
e. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.

D. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
1. Flat Sheet Thickness: 1-1/4 inch, minimum.
2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
a. Manufacturers:
1) Seieffe Corporation; OKITEae: www.okite.us/#sle.
2) Terrazzo & Marble Supply Companies; DIFINITI Quartz: www.tmsupply.com/#sle.
3) Wilsonart: www.wilsonart.com/#sle.
b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
c. Finish on Exposed Surfaces: Polished.
d. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 3/4 inch, minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
5. Skirts: As indicated on drawings.
6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled; see Section 01 6000 - Product Requirements.
3. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

F. Joint Sealant: Mildew-resistant silicone sealant, Color to match counter top material.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.

2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.
1. Where applied cove molding is not indicated use specified sealant.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SCHEDULES SEE DRAWINGS

END OF SECTION 12 3600

SECTION 22 0405
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following plumbing identification materials and their installation:

1. Pipe markers.
2. Valve tags.
3. Valve schedules.
4. Equipment labels.
5. Warning signs and labels.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Valve numbering scheme.
C. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with location of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
C. Self-Adhesive Pipe Markers: Are not allowed

2.02 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 3/32-inch thick laminated plastic with 2 black surfaces and white inner layer.
2. Valve-Tag Fasteners: Brass wire-link chain, beaded chain or S-hook.

2.03 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position

(open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.04 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Other equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Letter shall be a minimum of 1/2” high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.05 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: White.
C. Background Color: Yellow.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: Minimum 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information as indicated elsewhere in the specifications and on the Drawings.

PART 3 - EXECUTION

3.01 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, [**at least ¾ inch**] [**1-1/2 inches**] wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. Label 2 psi gas piping at 6 foot intervals.

3.03 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:
   a. Cold Water: **2 inches square**.
   b. Hot /HWR Water: **2 inches square**.
   c. Fire Protection: **2 inches square**.
2. Valve-Tag Color:
   a. Cold Water: **Natural**.
   b. Hot Water: **Blue**.
   c. Fire Protection: **Red**.
3. Letter Color:
   a. Cold Water: White
   b. Hot Water: **White**.
   c. Fire Protection: **White**.

3.04 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

END OF SECTION

SECTION 22 0410

GENERAL PROVISIONS - PLUMBING

PART 1 - GENERAL

1.01 SCOPE

A. Provisions of this Section apply to all Plumbing and Fire Protection work.

B. Include the provisions of General, Supplementary and Special Conditions and provisions of the Specifications shall apply to and form a part of this Section.

C. Provide all labor, materials, equipment, and services necessary for the completion of all work shown or specified, except work specifically specified to be done or furnished under other sections of the Specifications. Include performing all operations in connection with the complete installation in strict accordance with the specification and applicable drawings subject to the terms and conditions of the Contract, for the following system:

1. A system of sanitary waste and vent piping.
2. A system of domestic water piping.
3. A system of fire protection piping.
4. A system of storm (rainwater) piping.

D. Give required notices, file drawings obtain and pay for permits, deposits, and fees necessary for the installation of the work. Obtain and pay for inspections required by laws, ordinances, rules, regulations, or public authority having jurisdiction. Obtain and pay for certificates of such inspections and file such certificates with Owner.

E. "Provide" means to furnish and install, complete and ready for operation.

1.02 DRAWINGS

A. Drawings are diagrammatic and subject to requirements of Architectural Drawings. Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work**.** Coordinate with Architectural, Structural, Electrical, HVAC and other Building Drawings.

B. Follow the Drawings closely, check dimensions with Architectural Drawings and field conditions. DO NOT scale Drawings for location of system components.

C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or mis-located work.

D. Do not scale Drawings to locate sprinkler heads. Coordinate with lighting, ceiling grids, ceiling diffusers and/or reflected ceiling plans. Install Sprinkler Heads in center of ceiling tiles.

1.03 APPLICABLE CODES AND STANDARDS

A. Comply with the current editions of the following Codes and Standards:

1. ANSI/ASHRAE 15 - Code for Building Services Piping.
2. NFPA 70 - National Electrical Code.
3. NFPA 101 – National Life Safety Code.
4. Other Standards as referenced in other Sections of Division 22.
5. Local Building Code (International Building Code if no local Building Code in effect).
6. Local Plumbing Code (International Plumbing Code if no local Plumbing Code is in effect).
7. Local gas code (International Gas Code if no local code is in effect).
8. NFPA 13 - Sprinkler System installation.
9. NFPA 110 - Emergency and standby power.
10. NFPA 72 - National Fire Alarm and Signaling Code.

1.04 QUALIFICATIONS OF SUBCONTRACTOR

A. The Plumbing Contractor shall meet the following qualifications:

1. The Plumbing Contractor must be approved by the Architect.

2. The Plumbing Contractor shall have been in business as a Plumbing Contractor for at least three (3) years prior to Bid Date. He shall have a current Master's Plumber's Certificate and Gas Certificate of competency issued by the State of Florida and the city and county in which work occurs.
3. The Plumbing Contractor shall have a satisfactory experience record with Plumbing installations of character and scope comparable with this project, and for at least three (3) years prior to the Bid Date and shall have had an established service department capable of providing service inspection or full maintenance contracts.

B. The Fire Protection Sub-Contractor shall meet the following qualifications:

1. The Fire Protection Contractor shall be approved by the Architect,
2. The Fire Protection Contractor shall have been in business as a Fire Protection Contractor for at least three (3) years prior to the Bid date and shall be licensed by the State, County and City in which the work will be performed.
3. The Fire Protection Contractor shall have a satisfactory experience record with Fire Protection installations of character and scope comparable with this project and shall have completed three (3) such installations in the past three (3) years.
4. The Fire Protection Contractor shall be a Registered Engineer in the State in which the work occurs or be a Nicet Level 3.
5. The Fire Protection Contractor shall be the employer of the NICET Level 3 Designer. The NICET Level 3 designer will oversee installation and provide in closeout documentation.

1.05 CONFLICTS AND INTERFERENCES

A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.06 WORKMANSHIP

A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.07 COOPERATION

A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.08 VISITING SITE

A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

PART 2 - PRODUCTS

2.01 MATERIALS, SUBSTITUTIONS AND SUBMITTALS

A. Unless otherwise noted, provide new, standard, first-grade materials throughout. Equipment and materials furnished shall be fabricated by manufacturers regularly engaged in their production and shall be the standard and current model for which replacement parts are available. Equipment shall be substantially the same equipment of a given manufacturer which has been in successful commercial use and operation for at least three (3) years.

B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the Bid, without substitution, and shall be furnished under the Contract unless requests for substitutions are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.

C. Substitutions will be considered only if written request for approval has been received by the Architect TEN (10) DAYS prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which substitution is proposed and a complete description of the proposed substitute including drawings, cuts, performance and test data, samples and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment, or other Work that incorporation of the substitute may require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

D. If the Architect approves any proposed substitution prior to receipt of Proposals, approval will be set forth

in an Addendum. DO NOT rely upon approvals made in any other manner.

E. No substitutions will be considered after the Contract has been executed, except as described in the General Conditions.

F. Submittal data and shop drawings shall be submitted at one time, partial submittals will not be considered. Within 30 days of execution of Contract and before ordering materials and equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Number of Shop Drawings and procedure shall be as directed by the Architect.

G. All pressure vessels shall be constructed and tested in accordance with applicable ASME Codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.

H. Similar items of equipment shall be the product of the same Manufacturer.

I. See section, "ALTERNATES" in other sections of the Specifications and Bid accordingly.

2.02 SHOP DRAWINGS

A. Before starting work, submit and obtain approval of the following:

1. Equipment piping.
2. Plumbing Equipment, Products and Fixtures.

B. Thirty (30) days before starting work, submit Fire Protection Shop Drawings bearing the Seals of the Owner's underwriters and all governmental agencies having jurisdiction. Shop Drawings will not be considered without these seals. Complete shop drawings are required to be submitted at one (1) time.

1. Piping routing showing sizes, dimensions, elevations, and head locations (coordinate with reflected ceiling plan). Provide minimum six (6) sets of blue line drawings.
2. Provide a sprinkler head layout on a reflected ceiling plan. Indicate on plan all lights, HVAC ceiling air devices, smoke detectors, exit lights and any other ceiling attachments. Adjust locations of heads after Architectural review.

2.03 RECORD DRAWINGS

A. When work starts obtain from Architect two (2) complete sets of white prints of the Plumbing. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection.

B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one (1) complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this Contract.

C. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.

D. When work is completed Contractor shall purchase from the Architect (At Architects' printing cost) one (1) set of reproducible electronic files and prints of Plumbing Drawings for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the dwg record drawings, removing all superseded data in order to show the actual completed conditions.

1. Accurately show location, size and elevation of new exterior piping work and its relationship to any existing piping and utilities, obstructions, etc., contiguous to the area of work.
2. Block out areas modified by change-order and identify them by change-order number.

2.04 ELECTRICAL EQUIPMENT

A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.

B. Should the Contractor with the Architect's/Engineer's approval make changes in electrical equipment from those shown on the Electrical Drawings, he shall be responsible for the coordination and cost of required changes.

C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.

D. Verify electrical characteristics of all equipment and voltages available with Electrical Section prior to ordering any electrical equipment.

2.05 SLEEVES

A. Refer to the Architectural Life Safety Drawings for wall ratings and close all openings to match rating of wall.
B. Submit details of all pipe penetrations thru rated walls indicating wall construction, penetrating material and method of closing penetration including materials and listing of detail.
C. All Penetrations thru walls are to be closed. If the wall is not rated, sheet rock joint compound may be used to close space around piping. For walls with ratings opening shall be closed with a U.L. Listed rating system compatible with wall rating. Insulation is to be continuous thru all openings.
D. For pipe through floors inside rated chases or through non-fire-rated walls: 20 gauge galvanized steel sleeve 1/2" larger than pipe or pipe covering. Pipe insulation to be continuous thru sleeve. Seal opening between sleeve and pipe or pipe covering
E. For uninsulated pipe through 2 hour fire rated walls, partitions or floors outside chases: Hilti FS605 with sleeve, U.L. Listing #WL1056.
F. For insulated pipe passing through fire rated partitions or walls or floors outside chases: Hilti #FS611A with no sleeve, U.L. Listing #WL5029. Insulation: 1" thick fiberglass continuous thru wall.
G. For pipe passing thru concrete floor, concrete walls, and concrete block walls:
    1. Uninsulated Schedule 40 steel and copper: Hilti #FS605 with sleeve, U.L. #CAT1155.
    2. Insulated Schedule 40 steel and copper: Hilti #FS611A, U.L. #CAT5045.
H. For 4" and smaller PVC pipe passing thru 3 hour concrete floor, wall or concrete block wall - Hilti #FS611A with collar, UL System #CAJ095.
I. For 2" and smaller Schedule 40 PVC pipe penetrating a 1H12 concrete floor or wall - Hilti #FS611A sealant, UL #CAT2062 or UL #CAJ2066.
J. Under this Section, the Contractor shall be responsible for closing and making fire safe all openings exposed during construction (both new and existing) in the floor and deck above. Closing of opening shall be compatible with rating and shall not compromise the rating of the wall or floor being sealed.
K. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.
L. In Mechanical Rooms extend sleeves 1-1/2" above finish floor and waterproof.
M. Where exposed pipes pass through walls and partitions in finished or exposed spaces, provide chrome plated F & C plates or escutcheons. Seal wall penetration and case work penetration with silicone prior to installing escutcheon.
N. All wall floor penetrations shall be closed in a neat manner. The method used to the close penetrations shall be compatible with the rating of the wall and shall in no way compromise the integrity of the partition or floor.

2.06 ACCESS DOORS

A. Provide access doors for valves, and other items requiring maintenance located above hard ceilings or behind partitions or walls. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Provide door styles, sizes and colors as specified under the Architectural section.
B. Mark lay-in ceilings with paper brads at valve locations and maintenance access points. Bend ends of brads over above ceiling tile.

PART 3 - EXECUTION

3.01 PROTECTION OF EQUIPMENT

A. During construction all fixtures and equipment shall be protected from damage caused by weather, masonry, plaster, paint and job accidents.
B. When installation is complete, clean equipment and make ready for painting. Adjust all flush valves.

3.02 INSTALLATION OF FIXTURES AND EQUIPMENT:

A. Install fixtures and equipment to provide normal service access to all components.
B. Provide sufficient space for removing components, install fixtures and equipment to provide such clearance.
C. Install fixtures and equipment in accordance with manufacturer's instructions. If manufacture's instructions

conflict with contract documents, obtain Architect's decision before proceeding.

D. All fixtures and equipment shall be firmly fastened in place:

1. All wall hung fixtures shall be installed on a floor mounted fixture support with anchoring bolts all holes of each leg. Bolts shall be sized as per manufacturer's recommendation.

3.03 CUTTING AND PATCHING

A. Set sleeves and inserts and lay-out and form openings in walls, beams, girders and structural floors in this Section.

B. Cut, patch and repair as required to accomplish work and finish to match adjacent work. Architect's approval required before cutting any part where strength or appearance of finished work is involved.

C. Cutting, patching, and repairing of walls, floors, etc., where noted in paragraph "A" above, have been located or sized incorrectly are included in this Section.

3.04 INCIDENTAL WORK

A. All power wiring is included in Electrical Section.

B. Permanent drain and relief connections for **Plumbing Equipment** to nearest floor drain or to grade are included in this Section whether shown or not.

C. Items obviously omitted from drawings and/or specifications shall be called to attention of the Architect prior to submitting Bid, after award of Contract any changes or rearrangements necessary to complete Contract shall be at no additional cost to Owner.

3.05 FLASHING

A. Vent Pipe and Roof Drain Flashing: Specified in "Architectural Roofing Section".

B. Coordinate all roofing penetrations with Roofing Section.

3.06 EXCAVATION AND BACKFILLING

A. Include all excavation and backfilling required to bring the work to line and grade shown, including excavation of rock and all other materials which may be encountered.

B. Excavate trenches wide enough for proper installation of work. Grade trench bottoms evenly. Provide bell holes as necessary to insure uniform bearing for pipes. Excavate minimum 6" below pipe. Refill cuts below required pipe grade with sand or compacted gravel. Support pipe continuously along its entire length. Do not use piers to support piping.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas with "Engineered Fill", sand or fine gravel in accordance with requirements of "Sitework". Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe. Restore or repair pavements and the like after backfilling, to meet the requirements of the authority having jurisdiction.

3.07 PAINTING

A. Refinish equipment damaged during construction to new condition.

B. Paint all non-potable water pipe and insulation with two (2) coats of bright yellow paint in compliance with the Local Plumbing Code and these specifications. Paint piping prior to installing insulation. Paint type to be equal to Paint Specified in Painting Section of the Specifications.

C. Other painting is specified in "PAINTING SECTION, Finishes Division".

3.08 PIPE IDENTIFICATIONS

A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. Markers on lines 8" OD and smaller shall be taped in place; on lines over 8" OD secure with spring clips.

B. Submit samples of all nameplates, tags, chains and etc., for approval.

C. Protect all factory identification tags, nameplates, model, and serial numbers, stenciling, etc., during construction and replace if damaged.

D. Label Spacing and Extent:

1. On straight run of pipes; Above suspended ceilings space labels approximately 10 feet on center;

elsewhere, 20 feet on center.
2. Wherever a pipe enters or leaves a room or building.
3. At change of direction.
4. At main valves and control valves (not equipment valves).
5. On risers, just above and below floors.

3.09 VALVE TAGS

A. 2" X 3" laminated plastic with 1/2" numbers engraved at top, leaving space for further engraving by others. Secure tags with chains to valve yoke or stem, not handles.
B. Valve tags colors:
   1. Plumbing: Red tags with white numbers.
C. Valve tag locations: At all valves on mains, risers and branches.
D. Valve tag numbers: Starting with Number 1, number tags in sequence from the lowest point to the highest point in the building. In existing building extend existing sequences.
E. Starting with Number 1, number valve tags on this floor extending existing sequence. If there are no valve tags on existing valve, provide tags for all existing valves and new valves beginning floor sequence with Number 1.

3.10 VALVE CHARTS

A. In all mechanical rooms, provide charts showing number and locations of all valves, type of service, etc. Frame with aluminum, under glass.
B. In existing buildings include existing valves in the charts of new valves.

3.11 WARRANTY AND INSTRUCTIONS

A. See General Conditions - One-Year Warranty.
B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one (1) year after date of substantial completion of the Contract. Should any defects in materials, workmanship, or equipment be made know to Contractor within the one (1) year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.
C. After completion of the work, Contractor shall operate the equipment which he installs for a period of ten (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment. Furnish necessary oral and written operating instructions to the Owner's representative.
D. Provide three (3) sets of manufacturer's operating and maintenance manuals and parts lists including nearest manufacturer's sales and service representative by name, address and phone for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency there of. Include all warranty dates on equipment and guarantees. Include names, address and phone of any subcontractor and work performed. Bind above items in loose leaf three (3) ring binders with tab for each class of equipment.
E. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.
F. Make available to the Owner, without additional cost, service and adjustment of the equipment for the guarantee period.

3.12 PROJECT CLOSE-OUT DOCUMENTS

A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
   1. Record drawings – Plumbing & Fire Protection (reproducible). Electronic drawings dwg format and pdf format.
   2. Equipment and Fixture Submittal Data: List of manufacturers representative including name, address and telephone number that supplied requirement (3).
   3. Equipment operating and maintenance manuals including: Spare parts required (3).
   4. Maintenance schedule (3).
   5. Equipment warranty dates and guarantees (3).

6. List of Owner's Personnel who have received maintenance instructions.
7. Record of inspections indicating what system was tested, type of tests, date of tests and those parties witnessing tests.
8. Valve Tag Chart.
9. Current flow test.

END OF SECTION

SECTION 22 0420

TESTING, CLEANING AND ADJUSTING (TCA)

PART 1 - GENERAL

1.01 SCOPE

A. Provisions of this section apply to all Plumbing work.
B. Include Section 22 0410, "GENERAL PROVISIONS - PLUMBING AND FIRE PROTECTION", with this Section.
C. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 48 hour notice is required prior to performance of test.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. After system have been installed, Test, Balance and Adjust System for proper operation, flow rates, pressures and temperatures. Correct any noise and/or vibration conditions.
B. Perform all tests as required by local codes. Contractor shall furnish testing equipment. Keep a record of all tests indicating dates of tests, those persons witnessing tests and results of tests.
C. Provide with the Close-Out Documents a Testing Record.
D. If local Codes are more stringent, local Codes shall govern.

3.02 SANITARY WASTE AND VENT AND STORM SYSTEMS

A. Test piping by stopping lower outlets and filling with water to 10' hydrostatic head. Stop leaks and repeat test until watertight. All joints shall be exposed throughout test.
B. Provide "Ball Test" on all piping 3" and larger with ball 1/2" smaller than pipe diameter.
C. Provide visual inspection of all building drain piping below grade. Visual inspection shall be by means of a video camera routed through the drain system. Where the drain piping is connected to existing drain piping, the visual inspection shall include the existing drain piping from the point of connection, downstream to the point of connection to the public utility. A video tape and written report, noting any defects, on the findings of the visual inspection shall be provided to the owner with the close-out documents. The Plumbing Contractor shall provide personnel and equipment required for the visual inspection.

3.03 DOMESTIC WATER PIPING

A. On completion of roughing-in, cap all outlets, make connections with house supply line, and put under full water pressure. Test by applying additional pressure (by temporary pump or compressed air connection) to total hydrostatic pressure 1-1/2 times street pressure but not less than 150 psig for not less than 4 hours.
B. Immediately and completely stop all leaks and retest until system is watertight. After testing, leave general pressure on until ready to install fixture (except when necessary to drain to avoid freezing during construction). After completion of all tests, repairs and installation of fixtures, flush all domestic hot and cold water piping with water to remove all sediment scale and until water runs clear, then disinfect.
C. Disinfect piping with hypochlorite solution of chlorine or compressed chlorine gas applied through on approved chlorinator. Operate all valves and faucets several times to insure the chlorine reaches all parts of the system. Feed water and chlorination agent into the system at rates that will provide a residual chlorine content of not less than 50 ppm after a retention period of 6 hours and 10 ppm after a retention period of 24 hours. Upon completion of treatment, flush treated water from each system until the water supply is satisfactory to the public health authority having jurisdiction. Provide Architect a certificate of compliance from the local Health Department.
D. Clean air aerators, hose sprays, flush valves, etc. and adjust to proper flow rates.

3.04 FIRE PROTECTION PIPING TEST

A. Test in accordance with NFPA Pamphlets 13 and 20. Architects, Owner's, Underwriters and local Fire Marshall shall witness test. Provide certificate of inspection to the Architect/Engineer including the name of

those witnessing the test.

B. On completion of roughing-in and before connection to existing piping, cap all outlets, make connections with house supply line, and put under full water pressure. Test by applying additional pressure, by temporary pump or compressed air connection, to total hydrostatic pressure 1 1/2 times street pressure, but not less than 200 psig for a period of not less than four (4) hours. Immediately and completely stop all leaks. Retest when system is watertight.

C. After testing, leave general pressure on until ready to install sprinkler heads and fire department valves, etc. except when necessary to drain to avoid freezing during construction.

3.06 COMPLETION OF TEST

A. Upon completion of all testing, Contractor shall provide to the Architect copies of test results and include a listing of all personnel witness to the tests.

END OF SECTION

SECTION 22 0450

MATERIALS AND METHODS - PLUMBING

PART 1 - GENERAL

1.01 SCOPE

A. Include Section 22 0410, "GENERAL PROVISIONS - PLUMBING", with this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All pipe, fittings and valves shall be manufactured in the United States of America.
B. Pipe and fittings to be the same manufacturer.

2.02 SANITARY – WASTE AND VENT AND STORM PIPING

A. Vent piping smaller than 3" galvanized steel or cast iron. Waste piping 2" or smaller from fixture to stack; galvanized steel, cast iron. Other waste and vent piping within building cast iron.
B. Cast iron soil pipe: Cast iron non-hub pipe and fittings. CISPI Standard 301 shall be used below grade in kitchens where hot water will be discharged into the waste system. Cast iron piping shall be installed in all plenum areas.
C. Galvanized steel pipe: Schedule 40, ASTM A-12, with 150 lb., cast iron screwed drainage pattern fittings ASTM A-126.
D. PVC plastic pipe: PVC-DWV, ASTM D-2665. Transition to cast iron shall be made maximum of 6" above finish floor slab. "Foam Core" piping is not acceptable. PVC shall not be used for grease waste piping.
E. Joints for PVC plastic pipe: Solvent welded, ASTM B-2564
F. Joints for hubless cast iron pipe and fittings: Hubless pipe and fittings shall be joined by a heavy-duty coupling. Approved manufacturers: Husky SD 4000, Clamp All 125 or MG Couplings.
G. Joints in galvanized pipe: Screwed with Teflon tape applied in male threads.
H. Install vent stacks through roof. Terminate 12" above finish roof. Flashing is specified under Roofing Section.
I. Connect to site sanitary 5'-0" from Building. Verify with Civil Site Drawings exact size, location and invert of site sewer prior to beginning work.

2.05 DOMESTIC WATER PIPING

A. Copper Tube: ASTM B-88, copper water tube, Type "L" hard temper inside building, Type "K" outside building and below slab on grade. Fittings, cast brass or wrought copper water tube fittings, ANSI B-16.18 or B-16.22.
B. Plastic piping, PEX-A equal to Uponor.
C. Joints on copper tube:
    1. Inside Building: Properly cleaned fluxed and soldered as recommended by manufacturer, using 95-5 solder and 100% lead free flux.
    2. Outside Building and below slab on grade: "Sil-Fos".
D. Joints on plastic piping PEX-A: Cold expansion joints. Fittings and piping shall be same manufacturer.
E. Provide temporary construction water at site as required.
F. Connect to water service 5'-0" from building, provided and installed under Civil Section. Verify exact location with Civil Drawings.
G. All water piping installed below slab on grade to be type "K" soft copper bent up on both ends with no joints below slab.

2.06 VALVES

A. Domestic Water Piping Valves:
    1. Ball Valves: All bronze, 150 psig WP, chrome plated bar stock ball, full port Teflon seats, stem packing seal and thrust washer, Watts B-6080 or B-6081, Apollo 20-100, Red White 5044F or 5094F, Kitz 56 or 57. Provide valve handle extension to (minimum 1") clear insulation.
    2. Check valves 2" and smaller: All bronze, 125 psig WP, bronze disc, swing check, Stockham B-309, Crane 1342, Nibco S-413-B, Milwaukee 1509, Red White 237, Kitz 14.

3. Check valves 2-1/2" and larger: Iron body, bronze trim, switch check, 125 psig WP, Stockham G-931, Crane 373, Nibco F-918-B, Milwaukee F2974, Red White 435, Kitz 78.

B. Water pressure reducing valves: Watts, Wilkins, or Cash Acme, complete with inlet strainer, unions, inlet and outlet pressure gages and shut-off valve up stream of strainer.

C. Natural gas valves: Plug cocks 2-1/2" and larger, Rockwell 143; 2" and smaller, Rockwell 142, A.F.C. or Walworth, lubricated, 175 psi.

D. Gas pressure regulator:

1. System Regulator: Equal to Reliance Model 1893 with built-in under and over pressure shut off size and capacity as shown on drawings.
2. Appliance Regulator: Equal to Maxitrol 325-5 on 325-5M complete with vent limiting device. Valve shall be full line size and capacity as shown on Drawings.

2.07 PIPE HANGERS

A. General: Pipe hangers, Grinnell, PHD, Michigan Hanger, or Elcen. Grinnell figure numbers are given for reference. Provide copper clad hangers on bare copper lines.

B. Pipe hangers for lines 3" and smaller, adjustable wrought ring hangers, Grinnell Fig. 97 or wrought clevis hangers, Grinnell Fig. 260.

C. Pipe hangers for lines 4" and larger, adjustable wrought clevis hangers, Grinnell Fig. 260.

D. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.

E. Provide riser clamps on pipe risers on each floor. Clamps in contact with copper or plastic pipe, plastic coated.

F. Beam Clamps: Grinnell Fig. 229.

G. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Grinnell Fig. 282.

H. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (power driven anchors are not acceptable).

I. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8" and 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.

J. Space pipe hangers at maximum: 5' intervals for cast iron pipe with additional hanger at each fittings. Pipe hanger spacing for screwed, solder joint and welded piping: 1/2", 6 ft.; 3/4" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3", 12 ft.; 4" to 6", 14 ft.; 8" and over, 16 ft. Polypropylene and PVC plastic pipe 4 ft. horizontally maximum or as directed by manufacturer if closer, and 10 ft. vertically. Install additional hangers at change of direction and valve clusters.

K. Install pipe hangers on insulated pipe over pipe covering. Provide sheet metal saddle under hanger length to be 1-1/2 times the pipe diameter, minimum 12" long.

L. On sanitary piping requiring insulation, hanger may be installed directly on pipe and insulation installed over hanger.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

A. All piping shall be securely anchored in place to the Building Structure.

B. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.

C. Provide welding material and labor in accordance with the welding procedures of the Heating, Piping, and Air Conditioning Contractor's National Association or other approved procedure conforming to the requirements of ANSI B-31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxactylene welding. Provide full perimeter wells at both face end and collar end of each slip-on flange.

D. Install piping to allow for expansion. Make connections to all equipment to eliminate undue strains in

piping and equipment. Furnish necessary fittings and bends to avoid spring of pipes during assembly.

E. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.

F. Make pipe size reductions using reducing fittings. Bushings are prohibited.

G. Install 3/4" ball or gate valve drains with hose adapters at low points of water piping and at bases of all risers or where shown provide large drains.

H. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment.

I. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulation unions or couplings, equal to EPCO.

J. Run piping concealed, except where specifically shown or specified exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise.

K. Lay underground pressure piping so top of pipe is at least 18" below finished grade. Provide deeper bury if required by local regulations. Support all underground piping solidly along body of pipe. Strongly suspend other piping from building construction.

L. Run no piping or tubing in direct contact with slag fill. Where necessary to pass through slag, protect piping with not less than two (2) wrappings of polyvinyl chloride tape or equivalent protection approved by Architect.

M. Install shock arrestors as manufactured by J. R. Smith, Josam, Zurn or Wade as required by the IPC Plumbing Code and where indicated on drawings. Size in accordance with manufacturer requirements.

3.02 INSTALLATION OF VALVES

A. Provide shut-off valves where shown and detailed on Drawings. Locate valves to isolate each item to facilitate maintenance and/or removal.

B. Locate valves in piping connections to water heaters, etc., so heads and tube bundles can be removed without disconnecting equipment or piping other than union or flange connections immediately adjacent to heat exchangers.

C. Provide sweat to screw adapters where required.

D. In Buildings with water pressure exceeding 80 psig, provide and install a water pressure reducing valve(s) immediately upon entering building or as shown on Drawings. The P.R.V. shall be line size and have an integral strainer or separate WYE strainer up stream of P.R.V. Provide a ball or gate valve immediately upstream of P.R.V. and strainer.

END OF SECTION

SECTION 22 0451

GENERAL FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL:

1.01 RELATED DOCUMENTS

A. Division 1 – Section "ALTERNATES": Coordinate related Division 22 work and modify surrounding work to integrate the Work of each Alternate.

1.02 SUMMARY

A. Description of General Fire Protection Requirements. Applies to all Division 22, Section 22 0450's (Fire Protection).

1.03 DEFINITIONS

A. "Provide" means to furnish and install, complete and ready for operation.

1.04 REFERENCES

A. ASME: American Society for Mechanical Engineers.
B. ASTM: American Society of Testing and Materials.
C. AWWA: American Water Work Association.
D. FM: Factory Mutual.
E. NEMA: National Electrical Manufacturer's Association.
F. NFPA: National Fire Protection Association.
G. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
H. UL: Underwriters Laboratories, Inc.

1.05 REGULATORY REQUIREMENTS

A. Comply with current edition, unless otherwise noted, of the following codes and standards.

1. ANSI B31.9 - Building Services Piping.
2. ADA - American's with Disabilities Act.
3. NFPA 13 – Installation of Sprinkler System.
4. NFPA 30 – Flammable and Combustible Liquids Code.
5. NFPA 31 – Installation of Oil-Burning Equipment.
6. NFPA 45 – Fire Protection for Laboratories Code.
7. NFPA 54 – National Fuel Gas Code.
8. NFPA 70 - National Electrical Code.
9. NFPA 101 - Life Safety Code.
10. IBC - International Building Code with Fire, Mechanical, Plumbing and Gas Codes; 2023 Edition.

B. Permits, Licenses, Inspections and Fees.

1. Obtain and pay for all permits, licenses, inspections and fees, and comply with all rules, laws and ordinances pertaining to the Contractor's portion of the Work.
2. Obtain and pay for certificates of required inspections, and file certificates with Owner.

1.06 PRODUCT REQUIREMENTS

A. Provide new standard, materials throughout.
B. Multiple items of similar equipment shall be the product of the same manufacturer.
C. Substitutions:

1. Comply with the provisions of Division 1, Section "Product Requirements" and the following:
2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor's

bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved whatsoever, and the effect on other trades has been included in the Contractor's proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor furnishing the equipment.

3. The basis of design manufacturer's equipment has been used to determine space requirements. Should another approved manufacturer's equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
4. The basis of design manufacturer's equipment and scheduled Fire Protection equipment electrical requirements have been used to coordinate the electrical requirements of the plumbing equipment with the electrical systems serving that equipment.
    a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the electrical systems required by that equipment at no additional cost to the Owner.
    b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
    c. Prior to approval of submittals of Fire Protection equipment with electrical requirements that are greater or lower than those shown on the Drawings, Contractor shall submit letter verifying that required changes to the electrical system, serving the specific piece of equipment in question, have been coordinated with the electrical contractor. Letter to be included with the associated equipment submittal, addressed to the Architect with a copy to the electrical engineer.
5. Each bidder may submit to the Architect a list of any substitutes which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutes. To be considered, such requests must be delivered to the office of the Architect not later than 10 days prior to bid due date. The submittal shall include the following:
    a. Specific equipment or material proposed for substitution giving manufacturer, catalog and model number.
    b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
    c. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require.
6. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

1.07 SUBMITTALS

A. Submit under provisions of Division 1, Section "Submittal Procedures" and the following:

B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be provided under the 22 0450 Sections of Division 22.

1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
2. Call attention to deviations from specified items as to operation and physical

dimensions.

3. Performance curves for pumps shall be included.
4. Final equipment orders shall not be placed until submittals have been returned marked “No Exceptions Noted” or “Make Corrections Noted”.
5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensioned and drawn to 1/8" to 1'-0" scale. Submit six (6) prints of each drawing. Engineer will return five (5) of the prints with comments noted. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.

1. Fire Protection Systems. See Division 22, Section “Fire Protection System.”
2. For multi-story buildings, submit detailed floor penetration sleeve layout drawings. See Division 22, Section “Plumbing Basic Materials and Methods,” Article “Informational Submittals.”

1.08 COORDINATION DRAWINGS

A. General:

1. Within 60 days of Notice to Proceed provide Coordination Drawings for the following areas of the building:

   a. Auditorium (Include all Rigging)

2. Do not base Coordination Drawings on reproduction of Contract Documents or standard printed data.
3. Submitted Coordination Drawings are for information only and typically will not be returned to the Contractor. Architect will not take any action, but may define coordination conflicts or problems and inform the Contractor of such conflicts or problems.

B. Content:

1. Project specific information, drawn accurately to scale.
2. Show sequencing and spatial relationship of separate units of work that must function in a restricted manner to fit in the space provided, or function as indicated.
3. Indicate dimensions shown on Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

C. Format:

1. Coordination shop drawings shall be drawn to a scale of not smaller than ¼” = 1’-0”.
2. Provide drawings on electronic media in AutoCad .dwg format.
3. Provide layering system separate from wall outline and unique to each discipline.
4. In addition to plan view, provide sections as required to clarify congested situations and verify vertical clearances.
5. Base drawings and building sections in .dwg format will be provided by Architect.

D. Fire Protection Shop Drawings: Fire Protection subcontractor shall add all fire protection equipment, piping, sprinkler heads and other elements to database.

1. Upon completion of Fire Protection shop drawings, transmit electronic database to Electrical subcontractor.

E. General Contractor's Final Coordination: General Contractor shall thoroughly review shop

drawings, adding additional building elements where appropriate, and shall resolve conflicts, coordinating with the Architect, and the various subcontractors.

F. Submit Coordination Shop Drawings: Upon completion of final coordination, General Contractor shall approve coordination shop drawings and transmit 3 sets of hard copies and electronic files on CD's to Architect.

G. The Architect will not process fire protection shop drawings until such time as the coordination drawings have been sufficiently completed and conflicts resolved.

1.09 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:

1. Acceptable to, or licensed by, manufacturer.
2. Not less than 3 years experience with systems.
3. Successfully completed not less than 5 comparable scale projects using systems similar to those for this project.
4. Professional Engineer licensed in the State in which the work occurs; or NICET Level 3 and licensed by the State Fire Marshall in the State in which the work occurs. NICET Level 3 designer must be an employee of the Fire Protection Contractor. NICET Level 3 designer must oversee installation of shop drawings.

1.10 SUMMARY OF WORK

A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all fire protection work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

1.11 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with ceiling grids, lighting and other parts.

C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation and best appearance.

D. Where doubt arises as to the meaning of the Drawings and Specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural Drawings for all dimensions and location of lights, ceiling diffusers and sprinkler heads.

1.12 PROJECT/SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

B. Determine sizes and locations, and inverts of existing and new utilities near site.

C. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit under provisions of Division 1 Sections - "Closeout Procedures" and "Project Record Documents" and the following.

B. Record Drawings:

1. Keep accurate record of corrections, variations, and deviations, including those required

by change orders to the Fire Protection drawings.

2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints marked as noted above to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.
6. The Fire Protection Contractor shall use marked up drawing showing as-built conditions provided by Contractor to prepare Record Drawings. Asbuilt drawings shall be incorporated on electronic files.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:

1. Record drawings – fire protection piping/shop drawings, bond and electronic files in AutoCAD *.dwg & PDF format.
2. Equipment Submittal Data (2).
3. Equipment operating and maintenance manuals (2).
4. Equipment warranty dates and guarantees (2).
5. List of Owner's Personnel who have received operating and maintenance instructions.
6. Install valve charts and valve location plans in main mechanical room. (See Division 22, Section “Plumbing Identification.”)
7. Submit factory start-up/field reports for:

    a. Pressure Reducing Valve

D. Contractor’s Material and Test Certificate for above ground piping.

E. Contractor’s Material and Test Certificate for underground piping.

END OF SECTION

SECTION 22 0453

BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Description of common piping, equipment, materials, and installation for Fire Protection systems.

B. This Section includes the following:

1. Piping materials and installation instructions common to most Fire Protection piping systems.
2. Sleeves.
3. Concrete.
4. Grout.
5. Escutcheons.
6. Access doors - Building.
7. Flashing
8. Workmanship.
9. Cutting and patching.
10. Excavation, trenching and backfilling.
11. Piping systems installation - Common Requirements.
12. Equipment installation - Common Requirements.
13. Painting and finishing.
14. Concrete bases.
15. Supports and anchorages.
16. Protection and cleaning of equipment and materials.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Escutcheons.
3. Access doors - building.

1.04 INFORMATIONAL SUBMITTALS

A. Shop Drawings: For multi-story buildings, submit detailed drawings of the floor penetration sleeve sizes and locations, including the following information:

1. Fully dimensioned off column lines with location respective to adjacent walls shown.
2. Sleeve size.
3. Pipe size.
4. Pipe service.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for Plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for fire protection items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for Fire Protection Equipment:

1. Coordinate electrical system installation to match requirements of equipment actually furnished on this project.

2. Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system to accommodate Fire Protection equipment that has different electrical power requirements from that equipment used as basis of design, or power provisions, as shown on the electrical drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

2.02 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 22 Fire Protection Piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All piping and fittings prior to PRV shall be rated for 250psi.

2.03 JOINING MATERIALS

A. Refer to individual Division 22 Fire Protection Piping Sections for special joining materials not listed below.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 20 gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Firestopping Sealant: See Division 7 Sections “Through-Penetration Firestop Systems” and “Fire Resistive Joint Systems” for firestopping sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

2.05 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.07 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

1. Finish: Polished chrome-plated.

2.08 ACCESS DOORS – BUILDING

A. Manufacturers:

1. Bilco.
2. Milcor.
3. Nystrom.

B. Construction:

1. Door: 14-gauge, cold rolled steel.
2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
3. Hinge: Concealed spring hinge.
4. Latch: Screwdriver cam latch.
5. Finish: Phosphate dipped and prime coated.
6. UL labeled when in fire-rated construction with rating to match construction.
7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

C. Size: 18 inch x 18 inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

2.09 FLASHING

A. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.
B. Lead Flashing: Waterproofing, 5 lb/SF sheet lead.
C. Pitch Cups: 20 gauge galvanized steel, minimum 8 inches deep, bases mitered and soldered and extending at least 4 inches horizontally.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workman-like in appearance and performed by skilled craftsman.
B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.02 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Fire Protection work. Repair and finish to match surrounding.
B. Architect’s approval required before cutting any part where strength, or appearance of finished work is involved.
C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.
D. Core drill or saw cut openings in existing masonry construction.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered.
B. Grade bottom of trenches evenly and excavate bell holes to insure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.
C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel in accordance with requirements in Division 2. Section “Earthwork” no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.
D. Refer to Division 22, Fire Protection Piping Sections for specific bedding and backfill requirements.
E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., matching surroundings.
F. Restore all pavement cuts to meet the requirements of the cuts of the local authority.

3.04 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Fire Protection Piping Sections specifying piping systems.
B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas and stairwells.
D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping to permit valve servicing.
G. Install piping at indicated slopes.
H. Install piping free of sags and bends.
I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.
J. Select system components with pressure rating equal to or greater than system operating pressure.
K. Install escutcheons where exposed piping penetrates walls, ceilings, and floors in finished spaces.

3.05 SLEEVES

A. Sleeves are not required for core-drilled holes.
    1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
        a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
    2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    3. Use the following sleeve materials:
        a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
        b. Sleeves for Piping through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves 1/2 inch larger than pipe or pipe covering.
    4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk air tight.
    5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

6. Provide for continuous insulation wrapping thru sleeve.
7. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 7 Sections “Through Penetration Firestop Systems” and “Fire Resistive Joint Systems”.

3.06 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Fire Protection Piping Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

D. Flanged Joints:

1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.07 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.08 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer’s instructions. If manufacturer’s instructions conflict with Contract Documents, obtain Architect’s decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:

1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.09 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Fire Protection systems, equipment, and components are specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Painting of fire piping:

1. The following piping within boiler and chiller room shall be painted in its entirety under Division 9: Painting. Color codes are listed here for information only.
   a. Fire Protection Piping: Red Metaltex B47R3.
2. Should there be a conflict of colors in existing installations, contact the Architect.

3.10 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Equipment and piping stands and supports	4” high pad
Equipment located in equipment rooms, not listed above	4” high pad or as indicated on the Drawings

B. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12” on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.
C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.
D. Concrete pads shall extend a minimum of 4” beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.
E. Equipment attached directly to foundations or inertia bases; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation.
F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" requirements.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing and fire protection materials and equipment.
C. Field Welding: Comply with AWS D1.1.

3.12 GROUTING

A. Mix and install grout for Fire Protection equipment base bearing surfaces, pump and other equipment base plates, and anchors.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout.

3.13 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed Plumbing equipment, valves, etc.
B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.14 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Equipment and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction.
B. At completion of all work, thoroughly clean exposed materials (pipe, etc.) and equipment and make ready for painting.

END SECTION

SECTION 22 0455

FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, Fittings, Valves for:

1. Service from the water main to the building.
2. Wet sprinkler system.
3. Dry-pipe sprinkler system

B. System design and installation. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.

1. Sprinkler Protection:

a. Offices, lobbies, waiting areas, educational areas, dining areas, and corridors: Light hazard, 0.10 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.

b. Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 100 and 250 sq. ft.: Ordinary Hazard, Group 1, 0.15 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.

c. Utility and Maintenance rooms, storage rooms over 250 sq. ft., loading docks, energy centers areas: Ordinary Group 2, 0.20 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.

d. Provide sprinklers in accessible shafts per NFPA 13 latest edition.

2. Add water allowance of 250 gpm for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
4. Comply with IBC (2023 Edition), NFPA 13 (2022 Edition), NFPA 30, Flammable and Combustible Liquid Code, NFPA 45, Standard on Fire Protection for Laboratory Using Chemicals, NFPA 54, National Fuel Gas Code, NFPA 58, Liquefied Petroleum Gas Code, NFPA 70, National Electric Code, NFPA 72, National Alarm and Signaling Code, and NFPA 101, Life Safety Code (2021 Edition).

1.02 RELATED SECTIONS

A. Section 22 405 – Plumbing Identification.
B. Section 22 451 – General Fire Protection Requirements.
C. Section 22 453 – Basic Fire Protection Materials and Methods.

1.03 SYSTEM

A. A wet sprinkler system providing coverage for the entire building.
B. Fire service from approximately 5ft outside the building to inside the building.
C. A dry sprinkler system for those areas occurring outside the heated envelope of the building.

1.04 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 1, Section “Submittal Procedures” and the following:
B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be furnished under Division 22.

1. List shall be complete with manufacturer’s names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Performance curves for equipment such as pumps shall be included.

4. Final equipment orders shall not be placed until submittals have been returned marked “No Exceptions Noted” or “Make Corrections Noted”.
5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

C. Shop Drawings:

1. A reflected ceiling plan indicating locations of sprinkler heads, lights, HVAC devices, smoke detectors, exit lights and any additional items attached to ceiling. In lift out ceilings, sprinkler heads are to be centered in ceiling tiles. In hard ceilings, sprinkler heads to follow the general arrangement of the ceiling. After review by the Architect, revise layout as required.
2. Prepare a working pipe shop drawing based on hydraulic calculations. The piping shop drawing shall indicate routing and configuration of piping, size of pipe, piping support, elevation of piping and coordination of piping with ductwork. Shop drawings shall include low point drain downs.
3. Hydraulic calculations are to be prepared utilizing a current water flow test (maximum 90 days old). If current flow test is not available, obtain a current flow test and pay for all fees required.
4. If water flow information is not available due to new main extension or other construction which prohibits the availability of flow information at the start of construction, the contractor shall estimate probable flow information based on information available. Once permanent water is available at the site, the Contractor shall perform a flow test, incorporate the information into the calculation and make any modifications to the system as may be required.
5. When drawings and hydraulic calculations are submitted to the Engineer for review, they shall bear the seals of review and approval of the Architect, General Contractor, the Owners Insurance Underwriter, and the Nicet Level 3 Designer. The Nicet registered designer shall be an employee of the Fire Protection Installing Contractor and shall oversee installation of Project. Nicet registration seal shall be included on shop drawings.
6. Contractor to provide to the State reviewing Agency a set of shop drawings reviewed and approved by Engineer of Record as required by the State of Florida.
7. The Contractor shall incorporate all comments for approval by local Fire Marshall’s Office and any State of Florida Reviewing Agency. Contractor shall provide signed, and approved set of plans to Engineer upon approval by state and local authorities.
8. Each system calculations, components and alarming to be on shop drawings.

1.05 SYSTEM INSTALLATION AND INSPECTION

A. Required Inspections:

1. All underground and above ground fire line piping must be inspected by owner’s representative prior to being covered or concealed.

B. Fire Stopping:

1. All fire stopping of any and all fire rated assemblies must be inspected and approved by a State Inspector prior to the work being concealed.

C. Hydrostatic Testing Requirements:

1. The required hydrostatic testing of the underground and above ground fire line piping must be witnessed and approved by City Inspector prior to being covered or concealed.

D. Underground Fire Line Pipe Flush Test Requirements:

1. The required flush test of the underground fire line piping must be witnessed by an Owners representative prior to being connected to the above ground piping or riser.

E. Acceptance Inspections & Testing:

1. Allow fire protection and life safety systems installation and acceptance test must be inspected, test, witnessed and approved by an AHJ and Owner’s representative.

F. Plans Review & Approval:

1. All fire protection and life safety system drawings and specifications must be reviewed by this office to ensure code compliance prior to start of any work.

1.06 REGULATORY REQUIREMENTS

A. Materials: Conform to UL and FM Global Requirements and Standards.
B. Sprinkler System: Conform to NFPA 13, State of Alabama Fire Marshall Requirements, local Fire Requirements and Alabama State Building Commission Requirements.
C. NFPA 25, Inspections, Testing and Maintenance of Water-Based Fire Protection Systems.
D. NFPA 72, Standard for the Installation, Maintenance and Use of Protective Signaling Systems.
E. NFPA 72E, Standard on Automatic Fire Detectors.
F. Applicable Building Codes.
G. Welding Materials and Procedures: Conform to ASME Code.
H. Valves: Bear UL, FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
I. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.07 EXTRA MATERIALS

A. Provide extra sprinklers under provisions of NFPA 13, State and Local requirements.
B. Provide suitable wrenches for each sprinkler type.
C. Provide metal storage cabinet in location designated. (Designate location).

PART 2 - PRODUCTS

2.01 PIPING BELOW GRADE AND BELOW SLAB ON GRADE

A. Ductile Iron: Cement lined ANSI A-21.50.
B. Joints on Ductile Iron: Standard mechanical joint ANSI A-21.11. Provide with retainer glands at all fittings and thrust blocks minimum 1 cubic yard of concrete at all changes of direction.

2.02 WET SPRINKLER SYSTEM

A. Wet System - Above Ground Piping:

1. Black Steel Pipe:

a. All piping 1-1/2" and smaller, all piping larger than 1-1/2" with cut grooves on threaded and all welded piping, Schedule 40 black steel ASTM A53, ASTM A795, ASTM A135.
b. Piping larger than 1-1/2" for roll grooving only, Schedule 10 ASTM A795, ASTM B36.10. Schedule 10 pipe may not be used for threading or cut grooving. Schedule 7 pipe will note be accepted.
c. Cast iron threaded fittings ANSI B16.4 cast iron flanges and flanged fittings ANSI B16.1.
d. Malleable iron threaded fittings, ANSI B16.3.
e. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts and washers; galvanized for galvanized pipe.
f. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement into pipe.
g. Malleable Iron Fittings 175 lb. (250 lb.); ASME B16.3, threaded fittings.

Black Steel Piping and fittings shall be domestic manufacturer. Bull Moose Tube, Victaulic, or Wheatland are approved manufacturers. Substitutions require prior approval.

All piping and fittings prior to PRV shall be rated for 250psi.

2. Copper Tubing: ASTM B75; ASTM B88; Type K, hard drawn.

a. Fittings: ASME B16.22, wrought copper and bronze, solder joint, pressure type.
b. Joints: AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

Copper Piping and fittings shall be domestic manufacturer. Bull Moose Tube, ARGCO, Mueller, or Cerro are approved manufacturers. Substitutions require prior approval

B. Dry System – Attic

1. Piping for Dry Pipe systems and for drainage systems shall be Schedule 40 galvanized steel pipe, conforming to ASTM A795 with galvanized fittings, ANSI B16.4, galvanized coated, both interior and exterior of pipe and fittings.
2. Fittings for dry pipe systems:
   a. Fittings shall be threaded or grooved for pipe 2 inch and smaller and flanged or grooved for pipe 2-1/2 inch and larger. Contractor has option of providing threaded piping for 6 inch and larger.
   b. Ductile iron threaded fittings, ANSI B16.3 Class 300 hot-dipped galvanized conforming to ASTM A153.
   c. Cast iron threaded fittings, ANSI B16.4 Class 125 and 300 (extra heavy) hot-dipped galvanized conforming to ASTM A153.
   d. Cast iron flanged fittings, ANSI B16.1 Class 125 and 300 hot-dipped galvanized conforming to ASTM A153.
   e. Grooved couplings and fittings, as manufactured by Tyco, Anvil, Victaulic or equivalent.
   f. All groove couplings and fittings shall be hot-dipped galvanized conforming to ASTM A153 and furnished by a single manufacturer. Associated piping shall be roll-grooved.

C. Sprinklers

1. Sprinklers to be UL approved glass bulb quick response type.
2. All sprinkler heads to be rated for 175°F, unless otherwise noted on drawings.
3. Suspended Ceiling (Lay-in and Gypsum):
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.
   b. Type: Quick response concealed pendant type with painted cover plate.
   c. Cover Plate: White. Unless indicated otherwise. Provide color chart to Architect for color selection.
   d. Finish: Sprinkler Head – chrome plated.
   e. Fusible Link: Glass bulb type temperature rated for specific area hazard.
4. Exposed Area and Attic Type:
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.
   b. Type: Quick response upright type with guard.
   c. Finish: Brass or chrome plated.
   d. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   e. Guards: Finish to match sprinkler finish.
5. Sidewall Type:
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.

b. Type: Quick response recessed sidewall type.
c. Finish: Chrome plated.
d. Escutcheon Plate Finish: Chrome plated in color.
e. Fusible Link: Glass bulb type temperature rated for specific area hazard.

6. Dry Pendent Sprinklers (Cooler/Freezer and all areas subject to temperature below 40 deg F.):

a. Manufacturers:

1) Viking Model M.
2) Tyco, Reliable, Victaulic.

b. Type: Quick response recessed sidewall type with matching push on escutcheon plate.
c. Escutcheon Plate Finish: Chrome plated.
d. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Pipe Hangers and Supports:

1. Conform to NFPA 13.
2. Hangers for Pipe Sizes ½ to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Plate Support: Carbon steel ring, adjustable, copper plated.
10. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for drop.

Pipe hangers and supports shall be of one manufacturer. Grinnell, Anvil or Tolco are approved manufacturers. Substitutions require prior approval.

E. Gate Valves:

1. Up to and including 2 Inches:

a. Manufactures:

1) Nibco Model T-104-O.
2) Where Nibco is listed, Victaulic, Stockham, Watts, Tyco and Milwaukee are equal.

b. Bronze body, bronze trim 175 psi WP, UL Listed, rising stem, handwheel, solid wedge or disc, threaded ends.

2. Over 2 Inches:

a. Manufactures:

1) Nibco Model F-607-OTS.
2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.

b. Iron body, bronze trim 175 psi WP, UL Listed, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

F. Butterfly Valves:

1. Cast or Ductile Iron Body

a. Manufactures:

1) Nibco Model GD-4765-4/8.
2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.

2. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated, UL / FM approved.

G. Check Valves:

1. Up to and including 2-1/2 inches to 6 inches:

a. Manufacturers:

1) Nibco Model G-917-W.
2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.

b. Iron body and swing disc, bronze seat, stainless steel spring, grooved ends, 175 psi WP.

H. Water Flow Switch:

1. System sensor WFD water flow detector. Poetter Reomer, Viking, and Tyco are acceptable manufacturers.

I. Supervisory Switches:

1. System sensor OSY2 Model tamper detector. Poetter Roemer, Viking, and Tyco are acceptable manufacturers.

J. Fire Department Siamese Connection:

1. Crocker Figure No. 6410-PC chrome plated exposed with clappers, caps and chains.
2. Location to be coordinate with Fire Chief and Architect.

Elkhart, Croker and Guardian Fire are acceptable manufacturers

K. Test and Drain Assembly:

1. Viking Model A-1 complete with sight glass and ½" orifice for test purpose. Pipe discharge to drain riser on to exterior and spill on splash block.

Tyco, Victaulic, and Reliable are acceptable manufacturers.

L. Water Pressure Switch:

1. Switch for mounting horizontal or vertical, with two contacts.

M. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate electric alarm bell, accelerator, and with the following capabilities and features:

1. Activate electric alarm.
2. Test and drain valve.
3. Externally resettable.
4. Replaceable internal components without removing valve from installed position

2.03 FIRE STOP SYSTEMS

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls – sheet rock joint compound may be used to seal opening.

C. For piping passing through listed sheet rock walls or partitions:

1. Uninsulated pipe passing through 2 hour walls or partitions – minimum 5/8" depth of Hilti FS 605 filling annular space between wall and pipe on both sides of wall. U.L. Listing #WL1056.
2. Uninsulated pipe passing through 2 hour walls or partitions – minimum 1-1/4" depth of Hilti FS 601 filling annular space between pipe and wall on both sides of wall, U.L. Listing #WL1054.

D. For piping passing through concrete floors, concrete walls or concrete block walls.

1. Uninsulated Schedule 40 steel pipe; fill annular space between pipe and opening with Hilti #FS 605. U.L. Listing #CJ1184.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.

B. Connect to site fire service installed under another section. Verify the site with civil drawings for the exact size and location of the service prior to beginning work.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers form reinforcement concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

H. Pipe Hanger and Supports:

1. Install in accordance with NFPA 13 and NFPA 14.
2. Hangers on branch lines to comply with NFPA 13, 9.2.3.
3. Hangers on mains to comply with NFPA 13, 9.2.4.
4. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for a drop.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple trapeze hangers may be used.
7. Provide copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coast of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating floors and wall. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

N. Die cut threaded joints with full cut standard taper pipe threads and connect with Teflon tape or Teflon pipe compound applied to male threads.

O. Install valves with stems upright or horizontal, not inverted.

P. Provide valves for shut-off or isolating service and where shown on plans.

Q. Provide drain valves at main shut-off valves, low points of piping and apparatus.

R. Install piping in attic directly on top of joists. Install plastic sheeting over top of pipe and secure joists. Insulation to be installed over pipe and plastic sheeting.

S. Provide automatic sprinkler coverage at the bottom of hydraulic elevator shafts and elevator machine room in Accordance with NFPA 13 and local requirements.

T. Exterior exposed equipment shall be chrome plated.

U. All fire department or maintenance connections shall be coordinated with the Fire Department.
V. The fire protection contractor is responsible for coordination and labelling of fire devices supplied under this specification.
W. Where pipes penetrate exterior or finished surfaces escutcheons shall be used. Escutcheons shall be chrome finished and single piece design.
X. All devices and equipment shall be labelled as required by NFPA 13, 14, 24.

END OF SECTION

SECTION 22 0480

INSULATION - PLUMBING

PART 1 - GENERAL

1.01 SCOPE

A. Include Section 22 0410 "GENERAL PROVISIONS - PLUMBING AND FIRE PROTECTION", with this Section.
B. Repair existing insulation at points of connection to existing work.
C. "Exposed" is defined as: Exposed to view when construction is complete. Items which are not "exposed" are "concealed".
D. Insulate all items subject to sweating or loss of heat.
E. All insulation shall be installed by licensed applicator and applied in accordance with the Manufacturer's Recommendations.

1.02 INSULATION REQUIREMENTS

A. Comply with NFPA 90A.
B. Pipe hanger saddles are specified in Section 22 0450 "MATERIALS AND METHODS - PLUMBING"
C. Use insulation and adhesives with Underwriter's Laboratories flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding:
    1. 50 for pipe covering located in air ducts, plenum or casing.
    2. 150 for all other pipe, and equipment insulation.

PART 2 - PRODUCTS

2.01 FIBERGLASS PIPE COVERING

A. Snap-on glass fiber insulation minimum density 5#/cu. ft. maximum thermal conductivity at 75°F mean temperature 0.25 BTU/(hr) (sq. ft.) (°F/in.) with UL rated vinyl coated and embossed vapor barrier laminate of aluminum foil and kraft reinforced with glass fiber yarns (ASJ).
B. For all lines seal jacket with self sealing lap and staple with outward clinching staples 3" o.c. Butt adjoining sections of insulation tightly and seal with self-adhering butt joint strips.
C. Cover fittings to thickness of adjacent covering with factory pre-molded fitting covers. Cover flanged valve bodies with flanged unions. Do not cover screwed unions on hot lines. Finish fittings with a skim-coat of insulating cement and when cement is dry fitting shall be covered with glass fab and vinyl acrylic mastic. Finish fittings exposed in equipment rooms, boiler room, and in finished spaces with vinyl acrylic mastic over glass fab.
D. At Contractor's option, concealed tees may be insulated with field fabricated tee covers consisting of straight pipe covering on run of tee with notch at branch together with pipe covering on branch contoured to fit notch. Glass fab shall be applied around main, lapping contoured joint at branch by 1" minimum for the full circumference of joint. Cover entire fitting covering with vinyl- acrylic mastic over glass fab, 1/8" thick (dry) coat. Submit sample of fabricated tee covering to Architect for approval before work is begun.

2.02 ALUMINUM JACKET PIPING COVER

A. 0.010" thick corrugated aluminum jacket with laminated polyethylene and draft paper adhered liner.
B. Securely rivet jacket in place and band with flat aluminum bands 18" o.c.
C. Finish fittings on aluminum jacketed lines with 1/8" thick (dry) coat of vinyl acrylic mastic reinforced with glass cloth.

2.03 MANUFACTURERS

A. Acceptable Manufactures for Fiberglass Insulation Materials:
    1. Owens-Corning.
    2. Certaniteed.
    3. Knauf.
    4. Manville Corporation
B. Acceptable Manufacturers for Foamed Plastic Closed Cell Elastometric Insulation Materials:
    1. Armstrong AP.

2. Rubatex.

C. Acceptable Manufacturers for Adhesives, Mastics and Coatings:

1. Armstrong.
2. Benjamin Foster.
3. Childers.
4. Marathon.

D. Acceptable Manufacturers for Metal Jackets:

1. Childers.
2. Manville Metal-Loc.

2.04 SCHEDULES - PIPING

A. Plumbing Piping:

1. Domestic Cold Water Interior, Above Grade:

a. Glass Fiber Pipe Insulation

1) All pipe sizes: 1 inch thick.
2) Pipes located in walls: ½ inch thick.

b. Foamed Plastic Pipe Insulation

1) All pipe sizes: 1 inch thick.
2) Pipes located in walls: ½ inch thick.

2. Domestic Hot and Recirculating Water Interior, Above Grade:

a. Glass Fiber Pipe Insulation

1) All pipe sizes: 1-1/2 inch thick.
2) Pipe located in walls: 1 inch thick.

b. Foamed Plastic Pipe Insulation

1) All pipe sizes: 1 inch thick.
2) Pipes located in walls: ½ inch thick.

3. Floor Drain Bodies, Traps and Waste Piping Between Floor Drain and Waste Stack for Floor Drains Serving Refrigeration Equipment, Ice Machine and AC Units; Interior, Above Grade:

a. Glass Fiber Pipe Insulation

1) All pipe sizes: 1 inch thick.

4. Storm Piping and roof drain bodies:

a. Armaflex Pipe Insulation

1) All pipe sizes: ½" thick
2) Label Systems

2.05 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.
B. Factory Insulated Equipment: Do not insulate.
C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires or bands.
E. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
G. Finish insulation at supports, protrusions, and interruptions.
H. Equipment in Mechanical Rooms or Finished Spaces: Finish with canvas jacket or as scheduled.
I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.
K. Install in accordance with NAIMA National Insulation Standards.
L. Exposed Piping: Locate insulation and cover seams in least visible locations.
M. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
N. Fit pipe hangers over insulation.
O. Inserts and Shields:
    1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2 inches, provide insert.
    2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gauge as follows:
        a. Up to NPS 4: 12 inches long and 22 gauge.
        b. NPS 6: 18 inches long and 22 gauge.
        c. NPS 8 through 12: 24 inches long and 18 gauge.
        d. NPS 14 and Large: 24 inches long and 16 gauge.
    3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor barrier jacket specified for surrounding insulation. Insert shall be a minimum of 2 inches longer than the shield.
    4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
    5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
    6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."
P. Continue insulation through metal studs, walls, sleeves, pipe hangers, and other pipe penetrations. Finish firestopping at supports, protrusions, and interruptions. At fire separations, refer to Division 7 and Section 22410: Sleeves.
Q. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

PART 3 - EXECUTION

3.01 PLUMBING PIPING INSULATION

A. Bodies of floor drains serving refrigeration equipment, AC units and ice machines and traps and waste piping between such drains and waste stack: "Fiberglass Pipe Covering". 1" thick.
B. Cold water piping, interior, above grade: "Fiberglass Pipe Covering", 1" thick. Pipe insulation in partitions and chases may be 1/2" thick "Arma-cell" or approved equal.
C. Hot and Hot Water Return water piping, interior, above grade: "Fiberglass Pipe Covering", 1-1/2" thickness. Pipe insulation in partitions and chases may be 1" thick "Arma-cell" or approved equal.
D. Exposed P-Traps, stops and supplies on handicapped lavatories, and sinks. Equal to "PRO-WRAP" by McGuire.
E. Roof drain and overflow drain bodies and all storm piping above ceiling: "Fiberglass Pipe Covering", 1" thick.
F. Insulation with aluminum jacket: All exposed hot and cold water piping in Mechanical Rooms, Janitor's Closets and Water Heater Rooms.

END OF SECTION

SECTION 22 0490

FIXTURES AND EQUIPMENT - PLUMBING

1.00 PRODUCTS

1.01 SCOPE

A. Include Section 22 0410, "GENERAL PROVISIONS - PLUMBING ", with this Section.
B. Pay particular attention to requirements in the General Provisions for substitution of products not named or listed as substitutions.

PART 2 - PRODUCTS

2.01 CLEANOUTS

A. Furnish and install cleanouts where indicated on drawings and at all 90-degree bends, angle, upper terminals and not over 50 feet apart on straight runs. All cleanouts to have bronze countersunk tapered slotted plugs, except acid waste piping cleanouts, which shall be standard of piping system used. Flush-with-floor cleanout access covers shall have non-skid covers. All wall cleanout access covers shall have polished satin finish. All cleanouts shall be full size of pipe, piping larger than 6" shall have minimum 6" cleanout covers.
B. Exposed Cleanouts: Cast brass plug type, J.R. Smith #4470.
C. Wall type cleanout plug and access covers, J.R. Smith #4472. Cleanout plug must be within 1" of finish wall and must be tapped for access cover.
D. Install wall cleanouts on stacks at flush valve fixtures 12" above top of flush value, 12" above finish floor on sinks, lavatories and water coolers and 12" above grab bars at fixtures with grab bars. Locate cleanouts to clear baseboard at floor.
E. Floor type cleanout access covers: J.R. Smith #4248-NB. Plug must be within 3" of finished floor. Grout cleanout below access cover to seal watertight.
F. Outside Cleanouts: J.R. Smith #4258 cleanout access encased in a 18" X 18" X 6" deep concrete pad. See Detail on Drawings.

2.02 REDUCED PRESSURE ZONE BACKFLOW PREVENTER AND DOUBLE CHECK VALVE ASSEMBLIES

A. One (1) inch and larger: Equal to Watts #909 with gate valves and inlet strainer. Provide additional valve upstream of strainer. Clayton, Beeco, Febco, Conbraco, Wilkins or equal. Provide same size as piping.
B. One-half (1/2) inch and three-fourth (3/4) inch: Watts #9D, Wilkins #750, same size as pipe.
C. Pipe relief from backflow preventer full size to nearest floor drain. Provide factory made air gap for relief connection.
D. Double check valve assemblies: Watts, Clayton or Beeco.

2.03 PLUMBING FIXTURES AND EQUIPMENT

A. All “wetted” domestic potable fixtures, piping materials, valves shall meet the Federal Lead Free Guidelines. All materials shall be clearly marked and submitted with complete data during submittal review.
B. Unless otherwise specified, all fixtures complete as catalogued, commercial grade, white color, exposed metal trim chromium plated.
C. Fixtures and brass shall be securely anchored. Carriers shall be securely anchored to floor with lug bolts in all holes as recommended by the manufacturer.
D. Flush valve "YJ" supports shall be installed 1" below vacuum breaker on all water closet flush valves and around vacuum breaker on urinals.
E. Seal all fixtures at wall and floor with white silicone sealant. Seal countertop fixtures with clear silicone sealant.
F. Mount all fixtures at standard mounting height unless otherwise noted.
G. Furnish sinks and lavatories with correct number of drilling required by the faucet and accessories. Cock hole covers are not acceptable.
H. All items complete as catalogued as shown on drawings:

2.04 SUBSTITUTE MANUFACTURERS

A. Where Kohler is listed above, Crane, Eljer, American Standard or Zurn may be substituted.
B. Where J.R. Smith is listed above, Josam, Zurn or Wade may be substituted.
C. Where Elkay water coolers are mentioned above, Halsey Taylor, or Oasis may be substituted, only if water ways are constructed of totally lead free materials.
D. Where McGuire is listed above for traps, outlets and stops, EBC, Kohler, Crane, Eljer or American Standard may be substituted.
E. Where Symmons is listed above, Chicago Faucet or Powers, Zurn may substituted.
F. Where Chicago Faucet is listed, T&S Brass may be substituted.
G. Where Elkay sink (s) are listed above, Just may be substituted.
H. Where Church is listed above, Bemis, Beneke or Centoco may be substituted.
I. Where Lochinvar tank type water heaters are listed, A.O. Smith or Rheem may be substituted.
J. Where Stern Williams is listed above, Fiat may be substituted.
K. Where Sloan is listed, Toto and Zurn may be substituted.
L. Where Symmons is listed above for shower control valves, Speakman, Leonard, Powers, T&S or Zurn may be substituted.
M. Where Armstrong is listed above, the equal of B & G, Taco, Grundfos or Thrush may be substituted.

PART 2 - EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed in accordance with manufacturer's recommendation.
B. See details for mounting instruction and accessories.
C. Install electric water heaters so elements can be removed without disconnecting and/or removing heater.
D. Cleanouts on water closet stacks shall be installed minimum 12" above top of the flush valve on standard water closets, minimum 12" above top of grab bar on handicapped water closets and minimum 12" above tope of tanks on non-handicapped tank type water closets. On urinal locate cleanouts minimum 12" above top of flush valve on handicapped urinals and 12" above finish floor on standard units. On lavatories and sinks - 12" above finish floor and all other fixtures 12" above floor or above top of fixture.
F. Stops and supplies are to be installed with chrome plated brass nipples penetrating wall with deep escutcheon at wall. Compression type stops are not acceptable.
G. All floor mounted fixtures supports are to be securely attached to the floor using anchors in all mounting hole of size as recommended by manufacturer.
H. Provide wood backing in wall at all flush valve brackets and faucet supports and anchor brackets and supports to wood backing with anchors of sufficient length to penetrate backing.
I. Handicapped flush valve shall be installed with the pull handle on the open side or side opposite the adjacent wall.

END OF SECTION

SECTION 23 0100 - GENERAL PROVISIONS-HVAC

PART 1 GENERAL

1.01 SCOPE

A. HVAC means Heating, Ventilation and Air Conditioning.

B. Provisions of this Section apply to all HVAC and Control work.

C. Include the provisions of General, Supplementary and Special Conditions and provisions of the Specifications shall apply to and form a part of this Section.

D. Provide all labor, materials, equipment, and services necessary for the completion of all HVAC work shown or specified, except work specifically specified to be done or furnished under other sections of the Specifications. Include performing all operations in connection with the complete HVAC installation in strict accordance with the specification and applicable drawings subject to the terms and conditions of the Contract.

E. Give required notices, file drawings, obtain and pay for permits, deposits and fees necessary for the installation of the HVAC work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.

F. "Provide" means to furnish and install, complete and ready for operation.

G. All equipment shall be U.L. or E.T.L. Listed as an assembly.

1.02 DRAWINGS

A. HVAC Drawings are diagrammatic and subject to requirements of Architectural Drawings. HVAC Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work. Coordinate with Architectural, Structural, Electrical, Plumbing and other Building Drawings.

B. Follow the Drawings closely, check dimensions with Architectural Drawings and field conditions. DO NOT scale HVAC Drawings for location of system components.

C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or mislocated work.

D. Do not scale Drawings to locate ceiling diffusers. Coordinate with lighting, ceiling grids and/or reflected ceiling plans.

1.03 APPLICABLE CODES AND STANDARDS

A. Comply with the current editions of the following Codes and Standards:
   1. ANSI/ASHRAE 15 - Code for Building Services Piping.
   2. ANSI B9.1 - Safety Code for Mechanical Refrigeration.
   3. NFPA 70 2017 - National Electrical Code.
   4. NFPA 90A - Air Conditioning and Ventilating Systems.
   5. NFPA 91 - Blower and Exhaust Systems.
   6. NFPA 101 - Life Safety Code.
   7. 2013 ASHRAE 90.1
   8. Other Standard as referenced in other Sections of Divisions 15.
   9. 2021 International Building Code.
   10. 2021 International Plumbing Code.
   11. 2021 International Fuel Gas Code.
   12. 2021 International Mechanical Code.

1.04 QUALIFICATIONS OF SUBCONTRACTOR

A. The HVAC Contractor shall meet the following qualifications:
   1. The HVAC Contractor must be approved by the Architect.
   2. The HVAC Contractor shall have been in business as a HVAC Contractor for at least three (3) years prior to Bid Date.
   3. The HVAC Contractor shall have a satisfactory experience record with HVAC installations of character and scope comparable with this project and have completed five projects of the same cost (or more) as the cost of this project, and for at least three (3) years prior to the Bid Date shall have had an established service department capable of providing service inspection or full maintenance contracts.
   4. Contractor must have bonding capacity for project of this size and must bond the project.

1.05 CONFLICTS AND INTERFERENCES

A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.06 WORKMANSHIP

A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.07 COOPERATION

A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.08 VISITING SITE

A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

PART 2 PRODUCTS

2.01 MATERIALS, SUBSTITUTIONS AND SUBMITTALS

A. Unless otherwise noted, provide new, standard, first-grade materials throughout. Equipment and materials furnished shall be fabricated by manufacturer regularly engaged in their production and shall be the standard and current model for which replacement parts are available. HVAC equipment shall be substantially the same equipment of a given manufacturer which has been in successful commercial use and operation for at least three (3) years.

B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the Bid, without substitution, and shall be furnished under the Contract unless requests for substitutions are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.

C. Substitutions will be considered only if written request for approval has been received by the Architect ten (10) days prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which substitution is proposed, specification section/paragraph number and a complete description of the proposed substitute including drawings, cuts, performance and test data, samples and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

D. If the Architect approves any proposed substitution prior to receipt of Proposals, approval will be set forth in an Addendum. Do not rely upon approvals made in any other manner. Prior approval to be secured for "equal" or "approved equal" manufacturer.

E. No substitutions will be considered after the Contract has been executed, except as described in the General Conditions.

F. Submittal data and shop drawings, except controls, shall be submitted at one time, partial submittals will not be considered. Provide submittal in three (3) ring binders with tab sheets for each major item of equipment. Before ordering materials and equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Number of Shop Drawings and procedure shall be as directed by the Architect.

G. Architect and / or Engineer's approval of submittal data does not relieve the contractor of his responsibility to comply with the contract documents.

H. It is the responsibility of the Mechanical contractor to coordinate all Electrical requirements of the submitted equipment with the Electrical contractor. Any increase in cost due to a variance between the contract documents and the submitted equipment shall be the responsibility of the Mechanical Contractor.

I. All pressure vessels shall be constructed and tested in accordance with applicable ASME Codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.

J. Similar items of equipment shall be the product of the same Manufacturer.

K. See section, "ALTERNATES" in other section of the Specifications and Bid accordingly.

2.02 SHOP DRAWINGS

A. Before starting work, submit and obtain approval of detailed drawings of the following, fully dimensioned (including elevations of ductwork and piping) and drawn not less than 1/4"= 1'-0" scale. Submit one (1) set of paper or bond.
   1. Ductwork (do not scale diffuser locations, coordinate with ceiling grids and lighting layout). See Section 238600 "DUCT ACCESSORIES".
   2. Plenum casings.
   3. Complete mechanical equipment and fan room plans showing location of equipment, conduit stubs for motors, floor drains, and equipment pads and foundations.
   4. Equipment piping.

B. Submit complete control and power wiring diagrams for approval before installing controls. See Section 239000 "CONTROLS".

2.03 RECORD DRAWINGS

A. When work starts, obtain white prints of the HVAC Drawings. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection.

B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one (1) complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this Contract.

C. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.

D. When work is completed Contractor shall purchase from the Architect (At Architects' printing cost) one (1) set of mylar reproducible prints of HVAC Drawings for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the mylar record drawings, removing all superseded data in order to show the actual completed conditions.
   1. Accurately shown location, size and elevation of new exterior piping work and its relationship to any existing piping and utilities, obstructions, etc., contiguous to the area of work.

2. Block out areas modified by change-order and identify them by change-order number.

E. Ductwork and Control Drawings may be a set of mylar reproducible shop drawings, up-dated to show actual conditions at completion of work.

2.04 MOTORS, STARTERS AND ELECTRICAL EQUIPMENT:

A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.

B. Should the Contractor with the Architect's approval make changes in electrical equipment from those shown on the Electrical Drawings, he shall be responsible for the coordination and cost of required changes.

C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.

D. Motors:
1. 1750 RPM open drip-proof construction unless otherwise shown or specified. Integral horsepower three phase motors shall be of premium energy-efficient design with apparent efficiency (power factor X efficiency) not less than ASHRAE 90.1.
2. All motors served by variable frequency drives (VFD's) shall be inverter duty rated.
3. Unless shown otherwise motors less than 1/2 HP shall be single phase, motors 1/2 HP and larger shall be three phase.
4. Allis-Chalmer, General Electric, Goulds, Louis Allis, and Westinghouse.

E. Do not run motors until correct overload elements are installed in starters. Trading overload elements for elements of correct size for motors actually furnished shall be included in this Section.

F. Starters shall be in motor control centers, furnished mounted on packaged equipment or furnished in this section and installed under "ELECTRICAL SECTION" as indicated and/or shown on the Electrical Drawings. All starters furnished with fused control circuit transformers.

G. Starters shall be equipped with melting alloy terminal overload protection, in a 3 phase. Starters, unless indicated otherwise, shall be across-the-line type with overload and low voltage protection. Starting equipment shall comply with local utility company requirements.

H. Starters to be Square "D", Allen-Bradley, Cutler-Hammer or approved equal.

I. For single phase motors provide manual starters equal to Square "D" Class 2510. When installed in equipment rooms provide surface mounted enclosure, and when installed in finished walls outside equipment rooms provide flush mounted enclosure, key operated.

J. For three phase motors provide magnetic line voltage starters with NEMA I enclosures and melting alloy overload elements.

K. Provide non-fused combination magnetic line voltage starters with NEMA I enclosures and melting alloy overload protection.

L. Provide H-O-A switches, fused control circuit transformers, auxiliary contacts, etc., as shown on control diagrams or required by control sequences and/or arrange for these items to be furnished with the starters or motor control centers specified in Electrical Work.

M. All starters shall be by the same manufacturer.

N. Provide thermal overload with equipment for motors 1/2 HP and less at 120/1/60.

2.05 SLEEVES

A. For pipe through floors inside rated chases or through non-fire-rated walls: 20 gauge galvanized steel, 1/2" larger than pipe or covering.

B. For uninsulated pipe through fire rated walls or partitions or floors outside chases: Pipe Shields, Inc., Model WFB or approved equal at walls, Model DFB at floors.

C. For insulated pipe passing through fire rated partitions or walls or floors outside chases: Pipe Shields, Inc., Model WFB-CS for hot lines, VFB-CS-CW for cold lines. Insulation: Calcium silicate for hot lines and foamglass for cold lines, thickness specified for adjacent pipe covering.

D. For pipe through concrete beams: Schedule 40 black steel pipe, 1/2" larger than pipe or covering. Pipe covering passing through sleeve: calcium silicate in a 24 gauge galvanized steel shield similar to Pipe Shields, Inc. thermal hanger shield. Caulk space between bare pipe insulation jacket and beam with fire retardant rope at both ends of the sleeve and seal with 3M Brand fire barrier caulk CD 25 or Putty 303, thickness and application in strict accord with manufacturer's recommendations, minimum thickness 1".

E. At Contractor's option, instead of the factory fabricated sleeves specified above for pipe passing through floors and fire rated walls and partitions substitute 20 gauge galvanized steel sleeve 1/2" larger in diameter than pipe or pipe covering and seal one end of sleeve (both ends if both ends are exposed) with 3M Branch Fire Barrier Caulk CP25 or Putty 303, thickness and application in strict accord with manufacturer's recommendations, minimum thickness 1". Where pipe is insulated, insulation shall be continuous thru sleeve, calcium silicate for hot lines and foamglass for cold lines. In exposed areas, after product has dried it shall be sanded smooth for painting under painting section.

F. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.

G. Sleeves for ducts: See Fire Dampers (See Section 15860 "DUCT ACCESSORIES").

H. Extend sleeves 1-1/2" above finish floor and waterproof.

I. Where exposed ducts pass through walls and partitions, provide 4" wide 20 gauge galvanized steel closure plates except at grilles and registers. Fit closure plates snugly to duct and secure to wall. Grout around ducts and sound absorbers at equipment room walls.

J. Where exposed pipes pass through walls and partitions in finished spaces, provide chrome plated F & C plates or escutcheons.

2.06 ACCESS DOORS

A. Doors in non-fire rated walls and ceilings: 17-gauge steel with hinges and screwdriver latches, Bilco, Milcor, Miami-Carey, or equal. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Provide door styles compatible with adjoining surfaces as selected by Architect. Size doors to permit removal of equipment and/or maintenance, minimum size 18" X 18".

B. Mark lay-in ceilings with paper brads at maintenance access points. Bend ends of brads over above ceiling tile.

PART 3 EXECUTION

3.01 PROTECTION OF ROTATING PARTS

A. Equip exposed belt drives with belt guards with holes for measuring speeds of driven shafts.

B. Provide exposed couplings with coupling guards.

C. Equip propeller fans with guards.

D. Equip inlets and outlets of open centrifugal fans with 1-1/2" #10 Diamond mesh galvanized steel screens.

E. All motors or other equipment exposed to weather shall be provided with weatherproof covers.

3.02 PROTECTION OF EQUIPMENT

A. During construction, protect mechanical equipment from damage or deterioration.

B. When installation is complete, clean equipment and make ready for painting.

C. During construction all ductwork, piping, and equipment shall be stored in a clean/dry location. Any ductwork or piping stored outside that is not protected shall be removed from the job site. Installed ductwork and piping shall have open ends covered at the end of each work day to prevent dust, dirt, and water from entering the ductwork and piping.

3.03 INSTALLATION OF EQUIPMENT

A. Install equipment to provide normal service access to all components.

B. Provide sufficient space for removing components, install equipment to provide such clearance.

C. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with contract documents, obtain Architect's decision before proceeding.

D. All equipment shall be firmly fastened in place:
   1. Roof curbs shall be secured to deck and structure and curb mounted items shall be secured to curbs.
   2. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   3. Vibration isolators shall be secured to floors, pads or structure and equipment shall be bolted to the isolators.

3.04 EQUIPMENT SUPPORTS

A. Provide supports for ductwork, piping and equipment. Hot dip galvanize after fabrication all grillage, supports, etc., located outdoors.

B. Set all floor-mounted equipment, other than condensate pumps, on concrete pads or rails (as indicated of height shown, but not less than 4" high). Coordinate pad height with condensate drain trap requirements. Chamfer rails and pads 1". Where shown, provide reinforced floating pads mounted on vibration isolators. Form, reinforce and pour any pads and rails required but not shown on Structural and Architectural Drawings.

3.05 CUTTING AND PATCHING

A. Set sleeves and inserts and lay-out and form openings in walls, beams, girders and structural floors in this Section.

B. Cut, patch and repair as required to accomplish HVAC Work and finish to match adjacent work. Architect's approval required before cutting any part where strength or appearance of finished work is involved.

3.06 INCIDENTAL WORK

A. Provide all motors incidental to the Mechanical Systems. Wiring of motors, switches and starters is included in "ELECTRICAL SECTIONS".

B. Do all control wiring required for Mechanical work.

C. Provide motor starters as specified above.

D. Submit refrigerant piping diagrams as prepared by the HVAC Contractor and/or refrigeration equipment manufacturer for approval.

E. Final water connections to services are included in this Section.

F. Permanent drain connections for AC units, etc., and auto air vents to nearest floor drain are included in this Section.

G. Door louvers are not included in this Section.

H. Items obviously omitted from drawings and/or specifications shall be called to attention of the Architect prior to submitting Bid, after award of Contract any changes or rearrangements necessary to complete Contract shall be at no additional cost to Owner.

I. All return air and exhaust air grilles shall be covered with filter media if they are started and operated during construction.

3.07 FLASHING

A. General: Furnish all fans curbs, pitch cups, metal base flashing and counter flashing required for HVAC Work. Installation of above items is specified in "ROOFING SECTION" with coordination by HVAC Contractor.

B. Fan curbs for power roof ventilators are specified with the fans.

C. Pitch Cups: 20 gauge galvanized steel, at least 8" deep, bases mitered and soldered and extending at least 4" horizontally.

D. Metal Base Flashing: Galvanized steel for ferrous items, and stainless steel for stainless steel duct and aluminum for aluminum duct. Minimum thickness 22 gauge (0.034") galvanized steel, 20 gauge (0.038") stainless steel, 0.032" aluminum. Bases mitered and soldered extending out at least 4" horizontally and 8" vertically.

E. Metal Counter Flashing: Of material and gauges specified for base flashing, lapping base flashing at least 3".

3.08 EXCAVATION AND BACKFILLING

A. Include all excavation and backfilling required to bring the work to line and grade shown, including excavation of rock and all other materials which may be encountered.

B. Excavate trenches wide enough for proper installation of work. Grade trench bottoms evenly. Provide bell holes as necessary to insure uniform bearing for pipes. Excavate minimum 6" below pipe. Refill cuts below required pipe grade with sand or compacted gravel. Support pipe continuously along its entire length. Do not use piers to support piping.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas with "Engineered Fill", sand or fine gravel in accordance with requirements of "Sitework". Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe. Restore or repair pavements and the like after backfilling, matching adjacent work.

3.09 HVAC INSTALLATION OF AND CONNECTIONS TO ITEMS FURNISHED BY OTHERS OR SPECIFIED IN OTHER SECTIONS:

A. Duct Mounted Smoke Detectors: Install in duct.

3.10 PAINTING

A. Refinish equipment damaged during construction to new condition.

B. Paint all non-potable water pipe and insulation yellow in accordance with Plumbing Code using paint of type specified in Painting Section.

C. Paint un-insulated duct surfaces visible through grilles and registers flat black.

D. Other painting is specified in "PAINTING SECTION, Finishes Division".

3.11 PIPE IDENTIFICATIONS

A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. Markers on lines 8" OD and smaller shall be taped in place; on lines over 8" OD secure with spring clips.

B. Submit samples of all labels, tags, stencils, chains, etc., for approval.

C. Protect all factory identification tags, nameplates, model and serial numbers, stenciling, etc., during construction and replace if damaged.

D. Label Spacing and Extent:

1. On straight run of pipes; Above suspended ceilings space labels approximately 10 feet on center; elsewhere, 20 feet on center.
2. Wherever a pipe enters or leaves a room or building.
3. At change of direction.
4. At main valves and control valves (not equipment valves).
5. On risers, just above and below floors.

3.12 EQUIPMENT IDENTIFICATIONS

A. Provide 2" X 3" or larger laminated plastic nameplates with 1/2" numbers and letters in colors specified below. Screw tags to equipment in obvious locations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tags, leaving lower half of tag for future engraving by Owner.

B. Provide similar nameplates for motor starters furnished under this section.

C. Secure nameplates with acorn head screws.

D. Colors:
1. Equipment connected to utility power only - black letters on white nameplates.
2. Equipment connected to emergency power - red letters on white nameplates.

3.13 EXHAUST FAN IDENTIFICATIONS

A. 2" X 3" or larger laminated plastic nameplates with red letters and numbers on white background, identifying type of fans, number according to plans, and rooms served. Engrave on upper half of tag, leaving lower half for engraving by Owner. Fasten with acorn head screws.

3.14 DEMOLITION:

A. Certain existing HVAC equipment to be removed and/or relocated as shown or noted. Equipment removed will remain the property of the Owner unless designated otherwise. Remove from the premises all items not retained by the Owner.

3.15 CONNECTIONS TO EXISTING SYSTEMS:

A. Make connections to existing systems only at time authorized, in writing, by Owner.

B. Do not take heating system out of service during occupied working, office or school hours during heating season.

C. Drain existing systems and fill, vent, test, balance and put existing systems into operation after connections have been made.

D. Repair existing insulation at points of connection to existing work.

3.16 ACCESS DOORS

A. Provide access doors for valves, fire dampers, dampers, controls, air vents, and other items located above non-lift-out ceilings or behind partitions or walls.

3.17 USE OF HVAC SYSTEM DURING CONSTRUCTION

A. Ducted HVAC systems may be used during construction as long as the following conditions are met:
1. All AC units shall have filters installed in the AC units that are equal to the filters that are scheduled for each piece of equipment. The contractor shall be responsible for changing the filters in all AC units during construction at a minimum of every 30 days starting from the day the AC units are started. At the completion of the project, the contractor shall replace all filters.
2. All return air and outside air openings shall be protected with temporary filter media. The temporary filter media shall be changed by the contractor. Temporary filter media is required to protect the installed ductwork. During or after construction, if any ductwork is observed without temporary filter media, the contractor shall be solely responsible for cleaning the entire ductwork system and AC unit. Temporary filter media shall be changed bi-weekly at a minimum.

3. All AC units shall have all correct motor overload elements installed and all safeties shall be wired and operational prior to temporary use of the AC unit.
4. Temporary controls and temporary control sequences may be utilized by the contractor until the permanent controls and control sequences are installed. Temporary control methods shall be the sole responsibility of the contractor.
5. All AC units required to have factory start-up shall have factory start-up completed prior to use.
6. The building envelope for the area served by the AC units shall be substantially complete prior to using the AC units during construction.

B. Ductless split systems shall NOT be used during construction. Protect all indoor sections of ductless split systems during construction to prevent dust, dirt, or water from entering the unit.

3.18 WARRANTY AND INSTRUCTIONS

A. See General Conditions - One-Year Warranty.

B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one (1) year after date of substantial completion of the Contract. Should any defects in materials, workmanship, or equipment be made known to Contractor within the one (1) year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.

C. All centrifugal, reciprocating, screw or scroll type refrigeration compressors shall bear five (5) year non-pro-rated parts warranty.

D. All gas fired air furnaces shall bear ten (10) year prorated heat exchanger warranties.

E. After completion of the work, Contractor shall operate the equipment which he installs for a period of ten (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment. Furnish necessary oral and written operating instructions to the Owner's representative.

F. Provide five (5) sets of manufacturer's operating and maintenance manuals and parts lists including nearest manufacturer's sales and service representative by name, address and phone for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency. Include all warranty dates on equipment and guarantees. Include names, address and phone of any subcontractor and work performed. Bind above items in loose leaf three (3) ring binders with tab for each class of equipment.

G. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.

H. Supply initial charges of refrigerant, refrigeration lubricating oil; and anti-freeze necessary for the correct operation of the equipment. Maintain these charges during the guarantee period, with no additional cost to the Owner, unless loss of charge is the fault of the Owner.

I. Make available to the Owner, without additional cost, service and adjustment of the equipment for the guarantee period.
1. Service shall include:
    a. On call nuisance issues.
    b. Replenishing refrigerant and antifreeze if loss occurs due to system failure.
2. Service shall not include:
    a. Routine maintenance of the equipment unless specified in specific equipment specification section(s).

3.19 PROJECT CLOSE-OUT DOCUMENTS

A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
1. A letter signed by the subcontractors for HVAC, Electrical, and Temperature Control work stating that they have jointly checked each power circuit and control circuit and mutually agrees that controls and power circuits will function properly.

2. Record drawings - sheet metal work (reproducible).
3. Record drawings – control systems (reproducible).
4. Air balance report (3).
4. Equipment Submittal Data (3).
5. Equipment operating and maintenance manuals (3).
6. Maintenance schedule (3).
7. Equipment warranty dates and guarantees (3).
8. List of Owner's Personnel who have received maintenance instructions.
9. Control manufacturer's letter of certification (3).
10. Equipment start up reports (3).

END OF SECTION

SECTION 23 0200 - TESTING, BALANCING AND ADJUSTING (TBA)

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this section apply to all HVAC work.

B. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 48 hour notice is required prior to performance of test.

C. Provide complete report to Engineer for approval TEN (10) working days prior to Engineer's final site visit.

1.02 QUALIFICATIONS

A. All TBA work shall be performed by an independent Test and Balance Agency specializing in Testing, Balancing and Adjusting of HVAC Systems.

B. All TBA work shall be under supervision of a qualified registered professional engineer regularly engaged in the TBA Agency.

C. TBA Agency shall be an AABC or NEEB Member and/or shall obtain written approval from the Architect prior to Bidding.

1.03 APPROVAL

A. Application for approval of the TBA agency shall be submitted prior to Bid.

B. Submittal information regarding the TBA agency to include:
   1. List of at least five (5) projects successfully completed of similar size and scope.
   2. Copy of reporting forms to be used for this project indicating scope of TBA work.
   3. Name of registered engineer in charge with resume of qualifications. List of personnel that will perform TBA work on project and qualifications.
   4. List of instruments to be used with dates of latest calibrations.
   5. List of memberships in AABC, NEBB or other similar organizations.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. All instruments used for the TBA work shall be calibrated within six (6) months and checked for accuracy prior to start of work.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Prior to any work beginning perform, a pre-demolition test of all existing systems being affected by the renovation and/or the addition. Submit Test and Deficiency List as indicated below.

B. After HVAC system has been installed, Test, Balance and Adjust System for proper operation, air distribution, flow rates, temperatures and humidities. Correct any noise and/or vibration conditions.

C. Include a "Deficiency List" with the TBA air and water balance report. Deficiency list shall include TBA items which are not in accordance with Contract Documents.

D. Perform all tests as required by local codes. Contractor shall furnish testing equipment.

E. If local Codes are more stringent, local Codes shall govern.

3.02 AIR SYSTEM

A. When system has been completed, remove all trash and dirt, set grille bars and diffuser patterns for required throws and adjust and balance air duct systems so air quantities at outlets are as directed and distribution from each supply outlet is free from drafts and excessive noise, and uniform over the face of each outlet. Do all testing and balancing with filters blanked to provide pressure drops midway between clean condition and manufacturer's recommended change-out condition. Balance air quantities to within 10% of indicated air quantities.

B. Make adjustments so dampers and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Obtain additional pressure drop required for balancing of shorter runs by adjusting dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Change sheaves and belts as required to adjust AC units to proper airflow.

C. Balance variable volume air systems with warm supply air (outlets will open to design cfm).

D. Note that VAV terminals are specified to be factory calibrated. However, recalibrate each VAV box in the field as part of this work.

E. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but measure air quantities in ducts having velocities of 1000 feet per minute or more with pitot tubes. Cap pitot tube openings in low pressure ducts with plastic plugs. Cap pitot tube openings in medium and high pressure ducts and kitchen and laboratory exhaust ducts with Duro-Dyne test ports.

F. Permanently mark settings of dampers and other volume adjusting devices so they can be restored if disturbed.

G. When air balancing has been completed, submit to Architect an air balance log, including design and actual air quantities, pressures, etc., in each branch duct and at each grille, register, and outlet. Individual outlet air rates are required for boots on boot-box systems.

H. Include for each system the following information:
   1. Fan rpm, motor amps, motor nameplate amps, and amp rating of starter heater.
   2. Total air quantity supplied by each system and/or fan.
   3. Total outside air quantity supplied by each system.
   4. Provide velocity pressure across each duct mounted smoke detector and list manufacturer's required velocity pressure range.
   5. Air flow at all grilles.
   6. Static pressure profile thru each air handler.
   7. Air flow and static pressure profile at each VAV box.

3.03 COILS:

A. Provide the following:
   1. Entering and leaving air temperatures.
   2. Outside air temperature at time of test.
   3. Air pressure drop.

3.04 START-UP AND SERVICE

A. At the beginning of the first heating season, adjust and balance operating phases and repeat at the beginning of the first cooling season or vice-versa, as the case may be, all without charge.

B. The Contractor and Factory Representative of the boilers, chillers, AC units and major HVAC equipment shall place every item of such equipment into satisfactory operation with all automatic and safety devices. Further, all adjustment service required shall be performed during the warranty period. Adjustment services does not include lubricating fans or motors and does not include changing filters or adjusting belts.

C. In addition, submit equipment manufacturers' start-up reports for items listed above. See "Project Close-Out".

END OF SECTION

SECTION 23 0500 - MATERIALS AND METHODS-HVAC

PART 1 GENERAL

1.01 SCOPE

A. Include Section 23 0010, "GENERAL PROVISIONS - HVAC", with this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All pipe, fittings and valves shall be manufactured in the United States of America.

2.02 HVAC DRAIN PIPING

A. Standard weight galvanized steel pipe ASTM A-120 with galvanized malleable iron fittings, or type "L" hard copper with wrought copper sweat fittings or Schedule 40 PVC, at Contractor's option.

B. Provide drain traps for AC Unit drain pans. Size traps as required to drain under operating conditions.

2.03 REFRIGERATION PIPING:

A. ACR hard drawn copper tubing with wrought copper sweat fittings. Joints: Silfossed with continuous flow of dry nitrogen through lines.

B. Size suction and discharge lines so as to insure oil return at minimum loading.

C. Small lines 5/8" OD and smaller may be soft copper with flare fittings, provided that all joints are exposed for visual inspection.

D. Refrigerant piping shall be sized and installed as recommended by the equipment manufacturer. Provide lift traps or double suction risers as required for oil return.

2.04 PIPE HANGERS

A. General: Pipe hangers, Grinnell, PHD, Michigan Hanger, or Elcen. Grinnell figure numbers are given for reference. Provide copper clad or plastic-coated hangers on bare copper lines. Provide stainless steel or plastic-coated hangers in Pool areas subject to chlorine atmosphere.

B. Equip pipe hangers with vibration isolators as specified under sub-section 2.11 "VIBRATION ISOLATORS".

C. Pipe hangers for steam and condensate lines: Adjustable swivel roll hangers, Grinnell Fig. 171.

D. Pipe hangers for lines 3" and smaller (other than steam and condensate lines), adjustable wrought ring hangers, Grinnell Fig. 97 or wrought clevis hangers, Grinnell Fig. 260.

E. Pipe hangers for lines 4" and larger (other than steam and condensate lines), adjustable wrought ring hangers, Grinnell Fig. 260.

F. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guidelines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.

G. Provide riser clamps on pipe risers on each floor. Clamps in contact with copper or plastic pipe, plastic coated.

H. Beam Clamps: Grinnell Fig. 229.

I. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Grinnell Fig. 282.

J. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8" and 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.

K. Space pipe hangers at maximum: 5' intervals for cast iron pipe. Pipe hanger spacing for screwed, solder joint and welded piping: 1/2", 6 ft.; 3/4" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3", 12 ft.; 4", 14 ft.; 5", 12 ft. 6", 10 ft., 8" and over, 6 ft. Polypropylene and PVC plastic pipe 4 ft. horizontally maximum or as directed by manufacturer if closer, and 10 ft. vertically. Install additional hangers at change of direction and valve clusters.

L. Install pipe hangers on insulated pipe (other than steam and condensate lines) over pipe covering. Provide factory fabricated insulated pipe shields equal to Pipe Shields, Inc. "Thermal Hanger Shields" at hangers. Provide shield insulation of waterproofed calcium silicate for hot water piping and foam glass for chilled water piping, same thickness as adjacent pipe covering. At Contractor's option, pipe shields may be field fabricated using waterproof calcium silicate or foam glass insulation with ASJ and 20-gauge galvanized steel protector. Shield length: 1.5 times nominal pipe size but not less than 4".

M. Wrap bare copper refrigerant lines with sheet lead at hangers.

2.05 THERMOMETERS AND GAUGES

A. Mercury in glass red reading separable socket industrial thermometers with die cast metal or high impact plastic casings of appropriate pattern for each installation, 9" scale lengths and ranges shown, Palmer, Trerice, Weksler, Marsh or equal. Install thermometers in brass or stainless steel wells. Equip thermometers installed in insulated lines with 1" extension stems or long enough to permit unions to clear insulation whichever is greater.

B. Where shown install brass thermometer wells with screwed caps. Install wells at an angle to retain oil. Size well to fit thermometers specified.

C. Enlarge pipe 2" and smaller to 2-1/2" at thermometers and thermometer wells.

D. Install 4-1/2" dial pressure gauges where shown. Gauges shall have bronze or stainless steel bourbon tubes, 316 stainless steel or brass movement, non-ferrous or phenolic solid front cases, and accuracy not less than 1% of full scale over the entire range. Gauges shall be Ashcroft, Trerice, Weksler, U.S., Marsh or equal. Gauge with minimum bourbon tube diameter of 3". Provide brass or stainless bar stock needle valves for all pressure gauges. Provide siphons for steam gages.

E. Where shown, provide temperature and pressure measurement plugs and caps, equal to Peteron Equipment Co., Inc. "Pete's plug with Nordel seats and seals", flow design or approved equal. Provide one Pressure and Temperature Kit consisting of 0-100 psi pressure gauge with adapters, two (2) thermometers (25E - 125E F and 0E - 220E F), all in carrying cases.

2.06 VIBRATION ISOLATION

A. General: Mount all piping and rotating equipment using vibration isolators as specified below. Amber Booth, Korfund, Mason Industries, Peabody, Vibration Eliminator Co., or VMC. Mason Industries part numbers are given for reference. Minimum 95% isolation efficiency.

B. Isolators for Floor-Mounted Equipment: Laterally stable free-standing unhoused spring isolators with steel base plates, ribbed neoprene acoustical pads and leveling bolts, #SFL. Static deflections: as required to provide 95% isolation efficiency.

1. Mount items noted or shown on concrete inertia bases and mount the inertia bases on the isolators specified above.

C. Isolators for Suspended Equipment: Combination steel spring and rubber in shear isolators, #30N. Static deflections: As required to provide 95% isolation efficiency or 1" static deflection, whichever is greater. Provide isolators for all suspended rotating equipment.

D. Mount air handling unit sections in contact with concrete pad on single layer of ribbed neoprene on top of housekeeping pads as shown. Neoprene vibration pad shall cover the entire surface of the unit in contact with the concrete pad.

E. Provide snubbing isolators, similar to those specified above for pipe hangers for flexible connections at fans.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.

B. Provide welding material and labor in accordance with the welding procedures of the Heating, Piping, and Air Conditioning Contractors' National Association or other approved procedure conforming to the requirements of ANSI B31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxactylene welding. Provide full perimeter wells at both face end and collar end of each slip-on flange.

C. Install piping to allow for expansion. Make connections to all equipment to eliminate undue strains in piping and equipment. Furnish necessary fittings and bends to avoid spring of pipes during assembly.

D. Pitch air conditioning unit drain lines down in direction of flow 1" in 20'.

E. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.

F. Install 3/4" ball or gate valve drains with hose adapters at low points of water piping and at bases of all risers or where shown provide large drains.

G. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment. Provide rubber grommets at pipe penetrations to equipment casings.

H. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulation unions or couplings, equal to EPCO.

I. Near heating and air conditioning equipment requiring water valved and capped water outlets of sizes shown, for connection to equipment, including reduced pressure principal backflow preventers shall be provided. Make final connections under HVAC work. Note that all piping and insulation downstream of backflow preventer must be painted yellow.

J. Run piping concealed, except where specifically shown or specified exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise. All piping shall be ran as high as practical and not on the floor unless otherwise indicated.

3.02 REFRIGERATION SYSTEM

A. Split Systems: When system is complete, but before the pipe covering has been installed, test components with dry nitrogen and make tight at equipment manufacturer's recommended test pressures. Then evacuate the system to 26" Hg. vacuum which the system shall hold for 24 hours. After passing the above tests, charge and leak test under operating conditions using electronic leak detector.

B. Split and Packaged Systems: Check operation of refrigeration cycle and report head pressure, suction pressure and oil pressure.

END OF SECTION

SECTION 23 0800 - PIPING SPECIALTIES-HVAC

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this section apply to all HVAC work.

PART 2 PRODUCTS

2.01 SPECIALTIES - REFRIGERANT

A. Install molded desiccant core filter dryer in each liquid line. Provide throw away dryers for lines 1/2" and smaller. Provide replaceable core dryers for lines 5/8" and larger. Dryers shall be Sporlan "Catchall".

B. Install moisture indicating sight glass in each liquid line.

C. Service valves: Wing cap valves, Henry, or approved equal.

D. Expansion valves: Thermostatic valves with external equalizers, Sporlan, or approved equal.

E. Install solenoid valve in each liquid and hot gas bypass line as recommended by manufacturer. Hot gas solenoid valve shall be equipped with a high temperature coil.

F. Install suction line accumulators in all outdoor heat pumps and condensing units where refrigerant lines exceed 85' in length, or where recommended by manufacturer.

G. Refrigerant circuit access ports located outdoors shall be fitted with locking-type, tamper-resistant caps. Provide owner with any tools necessary to un-lock the caps.

PART 3 EXECUTION

3.01 INSTALLATION

A. Specialties shall be installed in accordance with manufacturer's recommendations.

B. See Details for mounting instructions and accessories.

END OF SECTION

SECTION 23 1800 – INSULATION

PART 1 GENERAL

1.01 SCOPE

A. Include Section 230100 "GENERAL PROVISIONS - HVAC", with this Section.

B. Repair existing insulation at points of connection to existing work.

C. "Exposed" is defined as: Exposed to view when construction is complete. Items which are not "exposed" are "concealed".

D. "Attic" is defined as any ceiling space that is adjacent to the roof.

E. Insulate all items subject to sweating or loss of heat.

F. All insulation shall be installed by licensed applicator and applied in accordance with the Manufacturer's Recommendations.

1.02 INSULATION REQUIREMENTS

A. Comply with NFPA 90A.

B. Pipe hanger shields are specified in Section 15050 "MATERIALS AND METHODS - HVAC".

C. Use insulation and adhesives with Underwriter's Laboratories flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding 50 for all other pipe, duct and equipment insulation.

PART 2 PRODUCTS

2.01 FOAM PLASTIC PIPE COVERING

A. Fire retardant foamed plastic pipe covering, maximum K factory at 75EF mean temperature not exceeding 0.27 BTU/(hr) (sq. ft.) (EF/in). Armstrong "Armaflex II", or approved equal.

B. Pipe covering may be seamless insulation slipped over piping before erection or may be slit longitudinally and installed over erected piping.

C. Make fitting covers from segments of pipe covering.

D. Cement all joints and seams in accordance with manufacturer's instruction using Armstrong 520 adhesive.

E. Fit pipe hangers over insulation (See PIPE HANGERS). Use hanger shields as specified under pipe hangers.

F. Thermal performance shall be as follows:
   1. 1" thick: R=4.2.
   2. 2" thick: R=8.0.

2.02 ALUMINUM JACKET PIPING COVER

A. 0.010" thick corrugated aluminum jacket with laminated polyethylene and draft paper adhered liner.

B. Securely rivet jacket in place and band with flat aluminum bands 18" o.c.

C. Finish fittings on aluminum jacketed lines with 1/8" thick (dry) coat of vinyl acrylic mastic reinforced with glass cloth.

2.03 DUCT INSULATION, EXTERNAL FOR CONCEALED

A. Formaldehyde free flexible glass fiber insulation with foil-scrim-craft (FSK) facing equal to Johnson Manville Micro-Lite XG. Flame spread classification, 25 or less, smoke developed rating not exceeding 50. Minimum density, 3/4 lb./cu. ft., 2" thickness, installed R=6.0 minimum.

2.04 DUCT INSULATION, INTERNAL:

A. Glass fiber acoustical/thermal insulation complying with NFPA 90A and UL 181 and having an erosion resistant anti-microbial membrane equal to Johns Manville, Linacoustic RC on the air side. Edge coating shall be factory applied to the edges of the liner core. Shop fabrication cuts and field cuts or tears shall be coated with Superseal Duct Butter. NRC (1" thick) not less than 0.70, minimum density 3 lb/cu. ft., and maximum friction correction factor at 2000 fpm average velocity 1.15 (per TIMA test method AHS-1S2-76U). Thermal performance shall be as follows:
   1. 1" thick: R=4.2.
   2. 1 1/2" thick: R=6.3.
   3. 2" thick: R=8.0.

PART 3 EXECUTION

3.01 HVAC PIPING INSULATION

A. Refrigerant Suction Lines and Hot Gas Bypass Lines: "Foam Plastic Pipe Covering", 1" thick. Jacket piping located outdoors or exposed to view with aluminum jacket.

B. AC Unit Drain Lines: "Foam Plastic Covering", 3/4" thick. Jacket piping located outdoors or exposed to view with aluminum jacket.

3.02 AIR TERMINAL DEVICES

A. Ceiling Mounted Supply Diffusers: 2" thick duct insulation on back of diffuser, external for concealed.

B. Fire Dampers for Internally Lined Ducts and Externally Insulated Ducts: 3" thick duct insulation on all sides, external for concealed.

3.03 DUCT INSULATION INTERNAL

A. Apply in accordance with SMACNA "Duct Liner Application Standard" over full coverage adhesive. Coat all edges with adhesive and seal all punctures or tears with mastic before installing ducts. Cut liner to assure overlapped and compressed longitudinal corner joints. Fasteners shall be sized appropriately for thickness of liner utilized. Provide mechanical fasteners and metal nosings as noted below:
   1. For all velocities, provide metal nosings on upstream edge of liner at connections to equipment: Fans, coils, dampers, AC Units, sound absorbers, etc.
   2. For velocities up to 2,000 feet per minute: Start fasteners within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and space them a maximum of 12"o.c. around the perimeter of the duct, except that they may be a maximum of 12" from a corner break. Elsewhere locate fasteners a maximum of 18" o.c., except that they shall be placed not more than 6" from a longitudinal joint of the liner nor more than 12" from a corner break.
   3. For velocities from 2,001 to 4,000 feet per minute: Start fasteners within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and space them a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere locate fasteners a maximum of 16" o.c., except that they shall be placed not more than 6" from a longitudinal joints of the liner nor more than 12" from a corner break. In addition to the adhesive edge coating of transverse joints, coat and longitudinal joints with adhesive.
   4. For velocities from 4,001 to 6,000 feet per minute: Same as 2 above except that metal nosing shall be installed to secure liner at all upstream transverse edges.
   5. Duct size shown does not include allowance for insulation.
   6. Where ducts are listed to be lined and wrapped, install wrap per section below "Duct Insulation, External, for Concealed Ducts"

B. Thickness and Extent:
   1. All transfer ductwork: 1” thick.
   2. Rectangular return ductwork: 1" thick.
   3. RTU-6 supply ductwork downstream of air terminal boxes: 1" thick.

3.04 DUCT INSULATION, EXTERNAL, FOR CONCEALED DUCTS

A. Adhere insulation to duct surface with approved adhesive applied in strips above 6" wide on approximately 12" centers. Flare door staples may be used for securing the insulation until the adhesive sets. Lap jacket and vapor seal all joints and seams with suitable mastic.

B. On rectangular and flat oval ducts 30" wide and wider, additionally support insulation with weld pins and speed clips 18" on centers. Seal weld pins with mastic and FSK tape.

C. Thickness and Extent:
   1. All supply ductwork not specified to be lined: 2" thick.

      NOTE: Conical and straight spin-ins on both lined and unlined ducts shall be insulated. Insulation shall be slit at damper rods, at spin-ins and sealed vapor tight.

3.05 DUCT INSULATION, EXTERNAL, FOR OUTSIDE DUCTS:

A. Insulate all exposed supply and return ducts with 2" thick 6 #/cu. ft. fiberglass board with FSK jacket in addition to the insulation specified above. Secure board with weld pins and speed clips 12" on centers. Seal clip indentations with mastic. Seal all joints and seams with mastic. Finish with aluminum jacket, 26 gauge, slope so rain will not stand on duct.

B. Cover all angles, seams and joint reinforcing with insulation and seal vapor tight.

3.06 INSULATION WETTED DURING CONSTRUCTION

A. Contractor shall replace any and all insulation wetted during construction at his own expense.

END OF SECTION

SECTION 23 7600

HEAT PUMP UNITS

PART 1 – GENERAL

1.01 SCOPE:

A. Provisions of this Section shall apply to all HVAC work.

PART 2 – PRODUCTS

2.01 MINI-SPLIT UNITS:

A. The system shall be a Mitsubishi Electric or equal by Trane, Daikin, Carrier, or Bryant split system with Variable Speed Inverter Compressor technology. The system shall consist of a ceiling or wall suspended indoor section with wired, wall mounted controller and a horizontal discharge, single phase outdoor unit.

B. Quality Assurance

1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
3. The units shall be rated in accordance with Air-conditioning Refrigeration Institute's (ARI) Standard 210 and bear the ARI Certification label.
4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
5. A dry air holding charge shall be provided in the indoor section.
6. The outdoor unit shall be pre-charged with R-410a refrigerant.
7. System efficiency shall meet or exceed 13.0 SEER.

C. Delivery, Storage and Handling

1. Unit shall be stored and handled according to the manufacturer's recommendations.
2. The wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

D. Warranty

1. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. The compressor shall have a warranty of 5 years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
2. Manufacturer shall have over 25 years of continuous experience in the U.S. market.

E. Performance

1. Each system shall perform in accordance to the ratings shown in the table below. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit. Heating

performance shall be based on 70°F DB, 60°F WB (21.1°C DB, 15.6°C WB) for the indoor unit and 47°F DB, 15°F WB (8.3°C DB, 6.1°C WB) for the outdoor unit.

F. Indoor Unit

1. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

2. Unit Cabinet
The casing shall be ABS plastic and have a Munsell 0.70Y 8.59/0.97 finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.

3. Fan
The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds: Low, M1, M2, and Hi.

4. Vane
There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control: 100% horizontal flow, 80% horizontal flow (plus 20% downward airflow), 60% horizontal airflow (plus 40% downward airflow), 40% horizontal airflow (plus 60% downward airflow), and swing. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

5. Filter
Return air shall be filtered by means of an easily removable washable filter.

6. Coil
The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

7. Electrical
The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall have an option of being supplied from the outdoor unit, using Mitsubishi Electric A-Control system or separate power source for indoor and outdoor units.

8. Control

a. The control system shall consist of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices.
b. For A-Control, a three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.
c. Where separate power is supplied to the indoor and outdoor units, a two (2) 20 ga. AWG wire shall be run between the units to provide forbid-directional control communication..
d. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
e. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.
f. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents in eight (8) different languages, including English, French, Chinese, German, Japanese, Spanish, Russian, and Italian.
g. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louver Swing button, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C). Temperature changes shall be by increments of 1°F (1°C) with a range of 67°F to 87°F (19°C to 30°C).
h. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat.
i. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems at a maximum developed control cable distance of 1,500 feet (500 meters).
j. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
k. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.

G.Outdoor Unit

1. The outdoor unit shall be compatible with the three different types of indoor units (wall mounted, ceiling suspending, and four way ceiling cassette). The connected indoor unit must be of the same capacity as the outdoor unit.
2. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions.
3. The outdoor unit shall be capable of operating at 0°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle may be required).
4. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.
5. System shall have a maximum refrigerant tubing length of 165 feet (50 meters) between indoor and outdoor units without the need for line size changes, traps or additional oil.
6. Cabinet
   The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a munsell 3Y 7.8/1.1 finish. The fan grille shall be of ABS plastic.
7. Fan
   The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.
8. Coil

   The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.
9. Compressor
   The compressor shall be a DC rotary compressor with Variable Compressor Speed Inverter Technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
10. Electrical
    The electrical power of the unit shall be 208volts or 230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

2.2 HEAT PUMP UNITS, PACKAGED

A. Air Handling Units: Supply fans, coils, filters, and drip pan, horizontal or vertical as shown.

B. Casings: Galvanized steel not lighter than 22-gauge, reinforced with angles or formed shapes with baked enamel finish over bonderizing. Casing panels: removable for access to fans, motors, coils, and bearings. Provide knockouts for piping and electrical connections. Casing shall be insulated with 1" thick neoprene coated duct liner meeting the requirements of NFPA 90A.

C. Provide statically and dynamically balanced belt or direct driven centrifugal fans with self aligning ball bearings, adjustable pitch motor pulley (3 speed), and adjustable motor base. Size belt drives for 50% overload. Fan motor and drive shall be located inside unit cabinet. Provide fan starting relay for each unit.

D. Coils include direct expansion coils and electric heating coils. Refrigerant and hydronic coils shall consist of non-ferrous fins securely bonded to seamless copper tubes and shall bear ARI approved ratings. Steam coils shall be steam distributing tube coils. Electric heaters shall comply with the requirements of Duct Heaters.

E. Drain Pans: Provide corrosion resistant coating and insulating corrosion-resistant fill.

F. Filters: 2" thick MERV 8 filters. Turn equipment over to Owner with clean filters.

G. Heating Components: Room side centrifugal fan with adjustable speed V-belt drive sized for 50% overload, heater section with alloy heat exchanger stainless steel ribbon burners, manual gas valves, automatic gas valve, pilot safety, electrically ignited pilot, high limit thermostat and bonnet thermostat. Combustion air and flue gas openings shall be raintight, arranged to permit operation under all normal wind conditions.

H. Provide five (5) year non-pro-rated compressor parts warranty and ten (10) years pro-rated gas fired heat exchanger parts warranty.

I. Provide a modulating hot gas reheat coil mounted after the DX coil to maintain space humidity as scheduled. Provide hot gas reheat valve and pipe the reheat coil series with the condenser coil. For AC units with multiple circuits, provide hot gas reheat on all circuits.

J. Units shall be manufactured by Trane, Bryant, Carrier, Daikin, or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Units shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

SECTION 23 7630

VAV PACKAGED UNITS

PART 1 - GENERAL

1.01 Scope

A. Provisions of this Section shall apply to all HVAC work.

PART 2 - PRODUCTS

2.01 PACKAGED 100% DEDICATED OUTSIDE AIR UNITS:

A. Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with R-454B compressor oil, factory run tested and shipped in one piece. Units shall be available for direct expansion cooling only, or direct expansion cooling with natural gas, electric, hot water or steam heating. Filters, outside air system, exhaust air system, optional non-fused disconnect switches and all operating and safety controls shall be furnished factory installed. All units shall be UL listed to US and Canadian Safety Standards. Cooling capacity shall be rated in accordance with AHRI Standard 360. All units shall have decals and tags to aid in service and indicate caution areas. Electrical diagrams shall be printed on long life water resistant material and shall ship attached to control panel doors

B. Casing: Exterior panels shall be zinc-coated, galvanized steel painted with a slate gray air-dry finish durable enough to withstand a minimum of 672 hours consecutive salt spray application in accordance with standard ASTM B117. Screws shall be zinc-plus-zinc chromate coated. Heavy gauge steel hinged access panels with tiebacks to secure door in open position shall provide access to filters and heating sections. Refrigeration components, supply air fan and compressor shall be accessible through removable panels as standard. Unit control panel, filter section, and gas heating section shall be accessible through hinged access panels as standard. Optional double wall construction hinged access doors shall provide access to filters, return/exhaust air, heating and supply fan section. All access doors and panels shall have neoprene gaskets. Interior surfaces or exterior casing members shall have ½ inch fiberglass insulation. Unit base shall be watertight with heavy gauge formed load-bearing members, formed recess and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tie down points.

C. Refrigeration Components: Variable speed compressors shall be capable of speed modulation from 25 Hz to a maximum of 100 Hz. The minimum unit capacity shall be 15% of full load or less. The compressor motor shall be a permanent magnet type. Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles. Compressors shall be equipped with a bearing oil injection system that optimizes bearing and scroll set lubrication, sealing, and controls the oil circulation rate. Optimal bearing lubrication shall be provided by a gear oil pump. Each variable speed compressor shall be matched with a specially designed variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions. Control of the variable speed compressor and inverter shall be integrated with the unit controller to ensure optimal equipment reliability and efficiency.

D. Condenser coils shall have all aluminum microchannel coils. All coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil shall be pressure tested to 650 psig. Subcooling circuit (s) shall be provided as standard.

E. All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with aluminum blades and zinc plated steel hubs. Condenser fan motors shall be three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather-tight slingers over motor bearings. Modulating condenser fans shall be provided.

F. Supply Fan: Direct drive plenum supply fan shall be one single width, single inlet 9-blade plenum fans. Fan blades shall be aluminum backward-inclined airfoil. Plenum fans shall be direct-driven. Entire assembly shall be completely isolated from unit and fan board by 2" deflection spring isolation. Multiple fan widths shall be available to optimize efficiency. Fan shall not require routine maintenance such as fan bearing lubrication, belt tensioning and replacement, sheave alignment, and setscrew torque checks

G. Provide Filter sections with 2" thick throwaway filters, MERV-13. Provide hinged and latched

H. Economizer: Economizer option shall be operated through the primary temperature controls to automatically utilize outside air for “free” cooling. Automatically modulated return and outside air dampers shall maintain proper temperature in the conditioned space. Economizer shall be equipped with an automatic lockout when the outdoor high ambient temperature is too high for proper cooling. Minimum position control shall be standard and adjustable at the user interface or through the building management system. A spring return motor shall ensure closure of OA dampers during unit shutdown or power interruption. Mechanical cooling shall be available to aid the economizer mode at any ambient.

Low leak dampers shall be provided with gasketing added to the damper blades and rolled stainless steel jamb seals to the sides of the damper assembly. Low leak economizer dampers shall have a leakage rate of 1 percent based on testing data completed in accordance with AMCA Standard 500 at AMCA Laboratories.

I. Relief Fan: Two, double-inlet, forward-curved fans shall be mounted on a common shaft with fixed sheave drive. All fans shall be dynamically balanced and tested in factory before being installed in unit. Relief fan shall be test run as part of unit final run test. Unit shall reach rated rpm before fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000- hour average life.

The modulating relief discharge dampers (or VFD) shall be modulated in response to building pressure. A differential pressure control system, shall use a differential pressure transducer to compare indoor building pressure to outdoor ambient atmospheric pressure. The FC relief fan shall be turned on when required to lower building static pressure setpoint.

J. Provide five (5) year non-pro-rated compressor parts warranty.

K. Provide hinged access doors for access to fans and filters. Doors shall be double wall construction.

L. Roof mounting curb shall be heavy gauge zinc coated steel with nominal two-inch by four-inch nailer setup. Supply/return air opening gasketing shall be provided. Curb shall ship knocked down for easy assembly. Channel shall be provided to allow for adjustment of return air opening location. Curb shall be manufactured to National Roofing Contractors Association guidelines.

M. Unit Mounted Controls: The unit controller shall be an application-specific, programmable controller that is factory installed and designed to control packaged HVAC equipment. A 7” user interface features a touch-sensitive color screen that provides facility managers with at-a-glance operating status, performance monitoring, scheduling changes and operating adjustments. Other advanced features shall include automated controller backup and optional features such as secure remote connectivity, wireless building communications, mobile device connectivity and custom programming with expandable I/O. Rooftop controller communication interface shall use the

BACnet protocol with an Ethernet (IEEE 802.3) or RS485 (EIA-485) physical interface and an appropriate data link technology as defined in ANSI®/ ASHRAE® Standard 135-2012 (for example, BACnet/IP, BACnet/MSTP). The rooftop controller shall be BTL listed as a BACnet Advanced Application Controller (B-AAC) as defined in ANSI/ASHRAE Standard 135-2012

N. Units shall be manufactured by Trane, Bryant, Carrier, Daikin or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. EXAMINATION

1. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
2. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
3. Proceed with installation only after all unsatisfactory conditions have been corrected.

B. INSTALLATION

1. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

C. CONNECTIONS

1. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
2. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
3. Duct installation and connection requirements are specified in Division 23 of this document.
4. Electrical installation requirements are specified in Division 26 of this document.

D. FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

E. START-UP SERVICE

1. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

F. DEMONSTRATION AND TRAINING

1. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01

Section Closeout Procedures and Demonstration and Training.

END OF SECTION

SECTION 23 7750

ELECTRIC HEATERS

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this Section shall apply to all HVAC work.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS

A. UL listed recessed convection heaters with finned sheathed heating elements, resiliently mounted direct driven propeller fan with motor heat shield, circuit breaker, concealed thermostat, concealed "On-Off" switch, high limit controls, and junction box for connecting power wiring.

B. Cabinets: 16-gauge steel, with pencil proof welded steel bar grilles (bars 1/16" X 3/8" minimum). Equip cabinet with adjustable recessing frame. Finish: Baked enamel, over bonderizing. Architect will select the color from manufacturer's standard selections.

C. Electric Wall Heaters: 2 KW and larger, Markel 3400 Series, less than 2 KW, Markel Series 3420, or approved equal.

2.02 ELECTRIC DUCT HEATERS

A. Slide-in heaters with all sheet metal parts inside duct aluminized or galvanized steel, listed in the Underwriters Laboratories, Inc. Electrical Appliance and Utilization Equipment List.

2.03 ELECTRIC UNIT HEATERS:

A. UL listed electric heater having capacity shown with resiliently mounted direct driven propeller fan with guard, finned-sheathed heating elements, and enameled steel enclosure not lighter than 20 gauge. Heater shall be equipped with automatic reset high limit controls, power contactors and control transformer for (120) (or) (24) volt control, factory wired to terminal strips.

B. For horizontal heaters provide adjustable horizontal louvers. For vertical heaters provide louver.

C. For each unit heater provide room thermostat to cycle contactor and fan.

D. Electric Unit Heater shall be manufactured by Chromalox, Markel, Berko, or approved equal.

2.04 ELECTRIC BASE-BOARD HEATERS:

A. UL listed finned sheathed heaters with enclosure having 16 gauge extruded aluminum fronts and top with extruded inlet and outlet grilles, 20 gauge steel backs and bottoms, finished end caps, inside and outside corner pieces.

B. For each heater furnish key operated thermostat and continuous bulb limit thermostat.

C. Finish: Anodized, color of Architect's selection.

D. Baseboard Heater shall be manufactured by Vulcan, QMark, Markel, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Units shall be installed in accordance with manufacturer's recommendations.

B. See Details for mounting instructions and accessories.

END OF SECTION

SECTION 23 8200 – FANS

PART 1 GENERAL

1.01 SCOPE

A. Include Section 23 0100, "GENERAL PROVISIONS - HVAC", with this section.

B. Provisions of this Section shall apply to all HVAC work.

PART 2 PRODUCTS

2.01 FANS, CENTRIFUGAL - GENERAL

A. Fan Rating: Certified in accordance with AMCA Standard 210 for capacity and sound. Provide fans of class required for service based on static pressures 20% greater than those scheduled. All fans are to be rated for continuous duty.

B. Provide forward curved blade, radial blade, backward curved blade or air foil blade fans statically and dynamically balanced with L (10) 80,000 hour rated self-aligning, grease lubricated ball or roller bearings rigidly supported by bearing stands.

C. For all fans furnish adjustable motor bases or rails.

D. Size V-belt drives for 50% overload, and provide adjustable pitch motor pulleys for drives of 15 BHP and smaller.

E. For all fans outside casings provide belt and drive guards.

F. Provide scroll access doors with quick-operating latches for all exhaust fans.

G. Equip all fans with flanged outlets and casing drains.

H. Sound power levels shall not exceed those shown.

I. Size fan motors to provide at least 5% drive loss, with motor service factors not exceeding 1.0. Provide premium efficiency motors as specified under "MOTORS".

J. Vibration isolators: See "MATERIALS AND METHODS" Section 230500.

2.02 FANS, CENTRIFUGAL ROOF EXHAUST:

A. Centrifugal power roof ventilators with AMCA certified air and sound ratings, belt or direct driven as shown. Provide permanently oiled bearings, statically and dynamically balanced backward curved blade wheels and spun aluminum housing with curb cap, disconnect switches, back-draft damper and outlet birdscreen. For belt driven fans provide V-belt drive sized for 50% overload, adjustable pitch motor pulley and adjustable motor base. For each fan furnish an 18 gauge galvanized steel insulated prefabricated curb with integral cant. Furnish baffled sound absorbing curbs where required to obtain noise level specified. Static pressure scheduled are external to sound curbs.

B. All roof mounted fans to be factory painted to match louvers, color by Architect

C. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, Twin City or approved equal.

2.03 FANS, CENTRIFUGAL IN-LINE:

A. AMCA approved air and sound rated direct (or) belt driven fans (as scheduled) complete with V-belt drive sized for 50% overload, self aligning grease lubricated ball bearings, adjustable pitch motor pulleys, adjustable motor bases and statically and dynamically balanced backward curved blade wheels, all enclosed in a galvanized steel housing with inlet bell and outlet duct collars. (Fan wheel and motor assembly shall be hinged for access.)

B. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, Twin City or approved equal.

2.04 FANS, CENTRIFUGAL CEILING EXHAUST:

A. AMCA rated direct drive centrifugal fans for ceiling mounting, complete with removable ceiling grille, disconnect, fan mounted solid state speed control, flexible duct connection, integral backdraft damper and discharge outlet.

B. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, Twin City, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Fans shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

SECTION 23 8400 – DUCTWORK

PART 1 GENERAL

1.01 SCOPE

A. Include Section 23 0100, "GENERAL PROVISIONS - HVAC", with this section.

B. Provisions of this Section shall apply to all HVAC work.

1.02 SHOP DRAWINGS:

A. Ductwork shop drawings shall include details of duct constructions: seams, joints, gauges, reinforcing and hanger details for each pressure class and size range together with details of turning vanes, branch connections, dampers and access doors and elevations of all ductwork.

PART 2 PRODUCTS

2.01 DUCTWORK - GENERAL:

A. Unless otherwise shown or specified construct ducts of galvanized steel sheet metal using gauges and recommended details as contained in the current edition of the SMACNA HVAC Duct Construction Standards. Ductwork shall include supply air, exhaust air, return air, and outdoor air ducts, together with all necessary fittings, splitters, dampers, quadrants, flexible connections, sleeves, hangers, support, braces, etc. Hang and install ducts in a neat and workmanlike manner from structural members (not roof deck) with adequate bracing and cross breaking to prevent breathing, rattling, and vibration.

B. No flexible ductwork on return, exhaust or outside air.

C. Install Duro-Dyne locking quadrants and Duro-Dyne end bearings on all splitters and manual volume dampers located above accessible ceiling and Young #1 regulator, C.P., and Duro-Dyne end bearings elsewhere.

D. Duct dimensions shown do not include allowance for internal insulation where required.

E. Duct Turns: Wherever possible, duct turns shall have a centerline radius equal to 1.5 times the duct width in the plane of the turn. Vane other duct turns to provide a dynamic loss co-efficient ("C") not greater than 0.2. No reducing ells or tees to be used.

F. Duct Sealing: Seal duct seams and joints as noted below. Seal entire circumference of all branch duct connections, tapping collars and spin-ins. Seal ducts using mastic sealant equal to United Duct Sealer.
   1. Class "A" Seal: Seal all joints and seams and leak test as specified.
   2. Class "B" Seal: Seal entire circumference of all transverse joints, seal all longitudinal joints.
   3. Class "C" Seal: Seal entire circumference of all transverse joints.
   4. Class "D" Seal: Seal corner of transverse joints.

2.02 DUCTWORK - LOW PRESSURE:

A. Ductwork: Low Pressure, Pressure and Seal Class shall include:
   1. All constant volume unit supply air ductwork and all supply air ductwork downstream of air terminal boxes: 2” pressure, class “B” seal.
   2. All return air ductwork: 2” pressure, class “B” seal.
   3. All outside air and exhaust air ductwork: 2” pressure, class “B” seal.

B. Construct ducts in accordance with SMACNA Duct Construction Standards for pressure and seal classes noted.

2.03 DUCTWORK - MEDIUM PRESSURE, RECTANGULAR:

A. Ductwork: Medium Pressure, Rectangular shall include: All VAV unit supply ductwork from unit outlet to air terminal box inlet.

B. Provide galvanized steel sheet metal ducts of sizes shown on plans, and construct gauges and recommended detail for 4",pressure class as contained in current edition of SMACNA Duct Construction Standards.

C. Seal all ducts to SMACNA Class (A) classification. Pressure test at:

1. 4" WG with maximum leakage of 1% of the total cfm of the system when tested at 4" WG.

2.04 DUCTWORK - MEDIUM PRESSURE, ROUND:

A. Medium pressure ductwork (round) includes all unlined round supply air ducts between VAV Unit outlet and air terminal box inlet.

B. Ductwork: Factory fabricated galvanized steel round spiral lock seam ducts of 26 gauge for ducts up to 8" diameter, 24 gauge for ducts up to 9" to 22", and 22 gauge for ducts 24" thru 26" in diameter and 20 gauge for duct over 36" in diameter. Lock seams shall be spaced on not more than 3" centers for ducts up to 5" in diameter, 6" centers for ducts from 6" thru 10", and 3" centers for ducts 12" and over in diameter.

C. At contractor's option ducts over 22" in diameter may be fabricated using sealed grooved or welded longitudinal seams. Gauges for longitudinal seam ducts: 20 gauge for duct from 24" to 36" in diameter, 18 gauge for 37" to 50", and 16-gauge for ducts over 51" in diameter.

D. Fabricate fittings by brazing or electric welding. Thickness of metal for round fittings: as specified for longitudinal seam ducts but not less than 22 gauge. Elbows shall have centerline radius of 1.5 diameters, 5 piece construction over 8" diameter, die stamped 8" and smaller. 90-degree take-offs shall be made with conical tees. Make connections to plenums with bell mouths.

E. Make transverse joints using beaded slip couplings, sealing compound equal to United Duct Seal, and sheet metal screws.

F. Pressure test high pressure duct at 4" WG SP. Maximum leakage at 4" WG pressure: 1% of the total cfm of the system.

G. Hang duct using 1" X 12-gauge straps at transverse joints but not more than 8'-0" apart. Straps shall completely encircle duct and shall be secured to construction with power driven studs.

H. Secure vertical ducts at floors using riser clamps.

J. United Sheet Metal Company, Eastern Sheet Metal Company or approved equal.

2.05 DUCTWORK LOCATED OUTDOORS:

A. Construct ducts served by exhaust fans as specified for respective exhaust ducts, above. Seal all seams weather tight using glass cloth tape and carbolastic or United Duct Sealer.

2.06 FLEXIBLE DUCTS:

A. Flexible duct connectors: A two (2) element spiral construction composed of galvanized steel supporting spiral and coated woven textile fabric with metal or mineral base, UL listed as Class I Air Duct and Connector (UL 181) minimum R=6.0.

B. Flexible connectors shall not exceed 5 feet in length.

C. Make connections between flexible ducts and other equipment using galvanized steel draw bands with plated screws and buckles and United Duct seal for high and medium pressure ducts and nylon draw bands for low pressure ducts.

D. Factory insulate cold flexible ducts using insulation equivalent to that specified for cold ducts.

E. Flexible ducts: Thermoflex M-KC, Wiremold 57K, Technaflex 57K, or Flexmaster Type 4M. Submit sample for approval of any other manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Ductwork shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

SECTION 23 8600 - DUCT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this Section shall apply to all HVAC work.

PART 2 PRODUCTS

2.01 SHEET METAL SPECIALTIES:

A. Make rectangular take-offs in low pressure supply, return and exhaust ducts using 45 degrees entry tap (SMACNA Duct Construction Standards Figure #2-8) with manual damper with end bearings and locking quadrant in branch. End bearings and quadrants shall have air tight duct connections and shaft seals: Ruskin, Duro-Dyne, or approved equal.

B. Manual balancing dampers: Comply with SMACNA Duct Construction Standards, Figure 2-14 and 2-15. Equip all dampers with locking quadrants and end bearings. End bearings and quadrants shall have air tight duct connections and shaft seal, Ruskin, Duro-Dyne, or approved equal.

C. When damper quadrants are located other than above lay-in ceilings.
   1. Provide all necessary accessories for remote control of balancing dampers without requiring access doors. Substitute Young #1 regulators and an additional end bearing or Ventlock #688 regulators and an additional end bearing for the quadrant (regulators shall be chrome plated), or, Architect/Engineer option.
   2. Provide access door for access to the quadrant (See sub-section 2.05 "ACCESS DOORS", hereinafter).

D. Provide "Stand-Offs" (hat sections) for damper quadrants, controls, etc., on externally insulated ducts.

E. Branch duct connections for connecting round low pressure branches to rectangular low pressure trunks: spin-in fittings with integral dampers with end bearings, stand-off and beaded collars. Seal Class of components penetrating duct shall be consistent with duct pressure class. Spin-in shall be Flexmaster - FLD. Submit sample for approval of other manufacturers for prior approval.

2.02 FIRE DAMPERS:

A. Install UL labeled 1-1/2 hour fire dampers wherever sheet metal ducts pass through chase walls, floors, outside fire chases, and elsewhere as shown or required by local Code. Install dampers per SMACNA "Fire Damper Guide" and UL 555.
   1. Fire dampers shall be Type "B" "Venation Blind" dampers. Unless otherwise shown folded blades shall not obstruct duct. Dampers in floors shall be spring loaded.
   2. Provide factory fabricated steel integral wall sleeve 3" longer than wall thickness for each fire damper and install sleeve using bolts and angles as detailed in Figure #1 of SMACNA "Fire Damper Guide".
   3. Provide rectangular, round and/or flat-oval collars. See Drawings for sizes and locations.
   4. For aluminum ductwork provide stainless steel fire dampers.

B. Install ceiling fire dampers in all fire rated ceiling as shown in Figure #11 of SMACNA "Fire Damper Guide" at ceiling penetrations as noted. Fire rated diffuser assembly to be approved for the specific UL Classification of the ceiling assembly used.

C. Install access door in low pressure ducts at each fire damper. Install wall or ceiling access door for access to fire dampers not accessible through lift-out ceilings. See sub-section 2.05 "ACCESS DOORS", below.

2.03 AUTOMATIC DAMPERS:

A. Factory fabricated dampers with extruded aluminum airfoil blades and frame with full gasket stops for blades ends. Equip blades with air tight plastic or butyl rubber seals and bronze or nylon bearings. Provide jamb seals. Damper widths from 12" to 60" wide shall not leak any greater than 8 cfm sq. ft.at 4" w.g. and a maximum of 3 CFM sq. ft. at 1" w.g Ruskin CD50 or approved equal.

B. Automatic dampers located near fan outlets or in ducts having maximum velocities exceeding 1500 FPM shall have extruded aluminum air-foil blades and all linkages shall be located outside of airstream. Such dampers shall have leakage rates not exceeding 1% maximum design flow at 4" WG pressure differential.

2.04 SMOKE DAMPERS AND SMOKE DETECTORS:

A. Comply with the requirements for automatic dampers. Smoke dampers shall be classified per UL 555S as Class 1 leakage rated smoke dampers.

B. Smoke detectors will be furnished and wired under Electrical Work but shall be installed in ducts under this Section.

C. Locate smoke detectors so that indicating lights are visible and so that they will not be affected by moisture from coils or humidifiers.

D. Operators for smoke dampers shall be 2 position spring return dampers motors with DDC operators. Arrange linkages to provide normally closed dampers. (See sub-section 239000 "CONTROLS", hereinafter).

E. Install access door in duct at each smoke damper and smoke detector. (See sub-section 2.05 "ACCESS DOORS", hereinafter).

2.05 ACCESS DOORS:

A. Access doors in low pressure ducts: Galvanized steel frame with gasket permanently secured to duct with a removable gasket access port held in place with screw driver or thumb operated latches. Door in insulated ducts: Double thickness with insulation. Doors in non-insulated ducts: A single thickness. Weld door frames to kitchen exhaust ducts. Size doors to permit removal of equipment or maintenance. Minimum size 12" X 12".

B. Mark access points in lift-out ceilings with brass paper brads. Bend points of brads over top of ceiling.

2.06 FLEXIBLE DUCT CONNECTIONS:

A. Install Neoprene coated glass cloth flexible connections at all duct connections to all fans and AC Units.

B. Install flexible connections in all ducts at building expansion joints.

2.07 ELECTRICAL GROUNDING:

A. Ground all fans.

B. Install braided copper jumpers around all flexible connections, taking care that jumpers do not bind flexes.

2.08 AIR FLOW MONITORS (AFM):

A. Thermal dispersion airflow measurement station. Shall be provided with insertion type mounting style, 304 stainless steel mounting bracket, aluminum alloy tube with individual sensors and BMS connectivity. Using recommended placement guidelines for the specified probe sensor density, measurement accuracy of 3% shall be provided.

B. Air flow measurement stations shall be Ebtron Advantage series or approved equal.

C. Install an access door in duct immediately upstream from each airflow measuring station.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Duct shall be installed in accordance with SMACNA Standards.

B. Equipment shall be installed in accordance with manufacturer's recommendations.

C. See details for mounting instructions and accessories.

END OF SECTION

SECTION 23 8700 - OUTLETS

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this Section shall apply to all HVAC work.

PART 2 PRODUCTS

2.01 GRILLES, REGISTERS AND DIFFUSERS

A. General: Air devices may be Titus, Price, Nailor, Krueger or approved equal. Where fire dampers are required at grilles, provide steel grilles, not aluminum.

B. Ceiling Return Grilles (R), Ceiling Exhaust Grilles (E) and Transfer Air Grilles (T): All aluminum, 1/2" X 1/2" X 1/2" cube core and plaster frames as needed. Off-white baked enamel finish. Provide 24 x 24 panel so grille will fit in 24 x 24 ceiling grid. Titus "50F".

C. Linear Supply Diffusers (LSD): Fixed pattern extruded aluminum, 2-way throw diffusers (designed for variable use), concealed attachment (no visible screws), mounted on outlet of galvanized steel boot with 1/2" internal insulation and round side inlet collar. Manual damper shall be provided at inlet collar or at branch duct spin-in connection for each diffuser with provisions for access to manual dampers for balancing. Where manual dampers are not accessible through lay-in ceiling provide manual damper in boot plenum above linear slot diffuser with screw driver adjustment through face of linear slot diffuser. Provide all necessary mounting clips and accessories for concealed attachment (no visible screws). Coordinate mounting frame with type ceilings shown on Architectural plans. Provide surface mounted with frame for plaster, gypboard or concealed spline type ceilings. Coordinate mounting for lay-in ceiling application including mitered corners, recessed end cap as may be required for diffuser to rest on grid and be flush with ceiling tile. Boot insulation shall comply with the requirements for internal duct insulation. Slot width to be 1" and NC less than 30. Finish off-white enamel Titus "ML" with "MP" plenum.

D. Supply Diffuser (S): The diffuser shall have an aluminum face panel, which shall be a one piece assembly, removable by means of four positive locking posts. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners. The face panel shall project 1/4" below the outside border of the diffuser back pan. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. The back pan shall be one piece precision dei-stamped and shall include an integrally drawn inlet. The diffuser back pan shall be constructed of aluminum. The finish shall be #26 white. The pencil hardness must be HB to H. Optional down blow clips shall be provided to restrict the discharge air in certain directions. The manufacturer shall provide published performance data for the square panel diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991. Diffuser shall be Titus "OMNI".

E. Supply Registers (SR): Adjustable vertical deflection, adjustable horizontal deflection, removable core, opposed blade damper and multi-blade scoop and baked aluminum enamel finish. Titus "272FS".

F. Wall Return Grilles (WRG): Horizontal bars fixed at about 35° angle, close spacing and plaster frames. Baked aluminum, enamel finish. Titus "350FL".

G. Wall Return Register (WRR): Horizontal bars fixed at about 35° angle, plaster frames and opposed blade damper. Baked aluminum, enamel finish. Titus "350FL".

2.02 VARIABLE VOLUME AIR TERMINAL BOXES:

A. Terminals shall be certified under the ARI Standard 880 Certification Program and carry the ARI Seal. Noncertified terminals may be submitted after testing at an independent testing laboratory under conditions selected by the engineering consultant in full compliance with ARI Standard 880. These tests

must be witnessed by the engineering consultant with all costs to be borne by the terminal manufacturer. Testing does not ensure acceptance.

B. Fibre-Free Liner: The terminal casing shall be minimum 22-gauge galvanized steel, internally lined with 1”-thick engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation shall be 1½ pound density, closed cell foam. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing. The casing shall be constructed to minimize leakage.

C. The damper shall be heavy gauge steel with shaft rotating in Delrin® self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage.

D. Actuators shall be capable of supplying at least 35-inch lbs. of torque to the damper shaft and shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork. Casing with access panel shall be constructed to minimize leakage.

E. At an inlet velocity of 2000 fpm, the minimum static pressure required to operate any terminal size shall not exceed 0.13-inch wg for the basic terminal. Maximum air pressure drop thru terminal, coil and attenuator (where required) shall not exceed 0.5" W.G.

F. Sound power levels referenced to 10 to the minus 12 watt in second through seventh octave bands, respectively, shall not exceed the following for boxes operating with 1" static pressure difference. Boxes up to 300 CFM: 67 dB, 62 dB, 51 dB, 47 dB, 43 dB and 36 dB. Boxes over to 300 CFM: 70 dB, 60 dB, 54 dB, 51 dB, 47 dB, and 44 dB. (For boxes serving operating rooms reduce allowable sound power level in each octave band by 10 dB). Provide rectangular sound absorbers if required to meet above noise criteria.

G. Attenuating box shall be constructed of galvanized steel sufficiently heavy to prevent oil canning and fluttering but not lighter than SMACNA gauge for 2" pressure class duct of same dimensions as box. Box shall have "Low Temperature Casing" and shall be lined with 1" thick sound insulation with vapor barrier complying with fire hazard classification specified for duct insulation. Insulation with fiber surface is not acceptable. Unit shall incorporate thermally isolated primary air at the inlet without causing condensation on the unit at ambient air conditions of 95°F. db/78°F. wb. No insulation edges shall be exposed in box. Each box shall be equipped with an access door for access to coil and volume regulator. (Provide galvanized double wall panels in boxes, such that no liner is exposed to the air stream.)

I. Box controls shall provide pressure independent operation and velocity sensors shall be of multiple point averaging type, unaffected by inlet conditions. (If box manufacturer requires straight duct on box inlet, such straight duct shall be furnished with the box.) All box controls except room thermostat and water coil valve shall be furnished with box and shall be calibrated by the box manufacturer. P.E. switch, volume limiter, etc. furnished by box manufacturer. Pressure taps and a calibration curve or similar method of field measuring box air rate shall be provide for each box. A photostat of the box control diagram shall be cemented to each box. Permanently mount all relays and pressure switches on box and provide protective cover for control items.

J. Control panel shall be capable of being mounted on opposite sides of VAV box. Contractor shall determine if this is required prior to ordering and shall determine left hand or right hand configuration.

L. Boxes shall be manufactured by Price, Enviro-Tech, Titus, Trane, or approved equal.

2.02 WEATHER LOUVERS:

A. Louvers shall be 6" thick extruded aluminum stationary louver with horizontally mounted drainable blades. 57% free area minimum based on testing 48 inches x 48 inches. Equip with 5/8" mesh aluminum birdscreen on inside of louver. Finishes: prime coat. Submit color sample to Architect (20 year warranty on finish). Ruskin ELF6375DX or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Duct shall be installed in accordance with SMACNA Standards.

B. Equipment shall be installed in accordance with manufacturer's recommendations.

C. See details for mounting instructions and accessories.

END OF SECTION

SECTION 23 9000 – CONTROLS

PART 1 GENERAL

1.01 SCOPE

A. Include Section 230010 "GENERAL PROVISIONS", with this Section.

B. Provisions of this Section shall apply to all HVAC work.

C. Refer to Section 239100 "BUILDING MONITORING AND CONTROL SYSTEM (BMCS)".

PART 2 PRODUCTS

2.01 CONTROL SYSTEMS:

A. Furnish and install complete and ready for operation an expansion to the existing Building Automation System with control sequences specified below.

B. Products of a manufacturer maintaining complete service and parts facilities in Florida continuously for the last three (3) years: Trane, Siemens, Daikin or approved equal.

C. Control equipment, except for items comprising an integral part of the water or refrigeration piping, shall be installed by trained mechanics employed by the Control Manufacturer.

D. Include the services of a full time control technician for calibrating and adjusting controls for the first 10 working days after Owner has occupied building.

E. Before installation, submit for approval five (5) copies of complete power and control wiring and piping diagrams. Hang a photostatic copy of the approved diagram, framed behind glass, in each equipment room. Provide one (1) set of reproducible sepias of "As-Built" control diagrams at completion of project for the Owner's use.

F. Provide permanent nameplates for control switches and motor starters. Nameplates: engraved laminated plastic with letters legible under normal operating conditions. (White on black).

G. Permanently identify control devices other than room thermostats, so they may be identified on control diagrams. Provide engraved plastic nameplates for items mounted outside of or on faces of panels. Mark other instruments with indelible ink.

2.02 CONTROL WIRING:

A. Include control and interlock wiring and power wiring for control panel in this Section.

Install in conduit in accordance with provisions of Electrical Work where exposed, concealed in walls or above ceilings other than lay-in type. Provide plenum rated cable above lay-in ceilings (for plenum or non-plenum).

B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls partitions.

C. Wire all devices individually to terminal strips in control panels.

D. Furnish necessary relays and auxiliary contactors and other accessories required. Provide interlock relays per NEC. Coordinate start-stop stations, auxiliary contacts, etc., with supplier of Starters, Variable Frequency Drive (VFD) and Motors Control Centers specified in Electrical Work.

2.03 CONTROL DEVICES:

A. Room Thermostats: Thermostats to be provided with local control, limited range of local control or control by BMCS as individually selected through BMCS. Thermostat covers: high impact plastic. Mount room thermostats with tops 4 feet above floors.

B. Remote Bulb Thermostats (DDC) and Temperature Transmitters (DDC): Unless otherwise shown use averaging elements not less than 12 feet long for duct or casing cross sections for each 24 square feet of face area.

C. Thermometers: Pipe line thermometers are specified in another Section. Install digital readout thermometers in ducts where shown on control diagrams, providing averaging bulbs where shown and/or required.

D. Freezestats: Manual reset, pneumatic not permitted. Locate freezestat bulbs between preheat and chilled water coils in units with chilled water coils and downstream from DX coils in units with DX coils. Provide coverage for each 3' X 3' coil face area section.

E. Differential Pressure Gauge / Switch:

Provide for proof of follow for all chillers, boilers, heat exchangers, etc. Pressure gauge / switch to be diaphragm type, 0-5 or 0-15 psid as required by system, minimum burst pressure 7000 psig, high temperature construction gauge / switch, ± 2% accuracy, CSA certified, 1/4" NPT ports, port orientation - Back, switch setting field adjustable, primary wetted parts - 316 s/s, secondary wetted parts 302 s/s and ceramic, dial size - 4.5", dial case to be flanged to mount to unistrut frame, casing to be made for outdoor / indoor use, provide analog out signal for the tin - in to BMCS. Differential pressure gauge / switch manufacturer shall be Orange Research Inc. or approved equal.

F. Valve and Damper Operators: Of sufficient power to close/open valves and dampers under operating conditions. Electric valve and damper motors shall have oil immersed gear trains and spring return to normal position. Valves and damper operators to have DDC Controls.

G. Capillary Supports: Securely support all duct-mounted and casing- mounting thermostat capillaries using factory fabricated copper bulb supports.

H. Provide stand-offs for control devices mounted on externally insulated ducts and equipment.

I. Anchor all items mounted on gypsum board (dry-wall) using toggle bolts or moly bolts, not expansion shields.

J. Air flow Measuring Station (AFMS): Provide AFMS with probe, transmitter and cable. Unit to average velocity profile thru multiple probes and provide average readout in CFM on transmitters LED screen. Provide O-10VDC and 4-20MA output (field selectable) to BMCS. Sensor accuracy to be 2%, installed accuracy to be 3%. ARMS to be Ebtron model GTX116.

2.04 CONTROL POWER:

A. Direct Digital Control (DDC). All 120 Volt wiring shall be the responsibility of the Control Sub-Contractor from circuit furnished under Electrical Section. Coordinate circuit locations with General and Electrical Contractors.

B. Power wiring to all automatic dampers shall be included under this section.

C. Wiring and relays between light and fans for interlock shall be included under this section.

2.05 CONTROL PANELS:

A. Local Control Panels: Construct of galvanized steel with baked enamel finish or aluminum-plywood-aluminum fronts and backs and extruded tops, bottoms, and ends. All panels shall have piano hinges and key locking latches (key panels alike). Permanently label instruments located in panels consistent with labeling on control diagram. Cement photostat of approved diagram inside each panel cover. (Include Local-Remote switching for control point adjusters on face of each panel).

2.06 INTERFACES WITH BUILDING MANAGEMENT CONTROL SYSTEM (BMCS):

A. Relays actuated by BMCS will be mounted in BMCS Panels located in Fan Rooms, Equipment Rooms, etc.

B. Wiring from local panels (and Engineer panels) to BMCS panels is included in this Section.

C. Control point adjusters actuated by BMCS system will be located in BMCS Panels.

2.07 CONTROL SEQUENCES:

A. As indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Control diagrams on drawings and/or Control Sequences are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown.

END OF SECTION

SECTION 23 9100 – BUILDING MANAGEMENT CONTROL SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The General, Supplementary and Special Conditions and provisions of the Specifications shall apply to and form a part of this section.

B. Provisions of this Section shall apply to all HVAC work.

C. Refer to Section 239000 "CONTROLS".

D. Give all requisite notices, file plans if required, obtain and pay for all permits and pay all deposits and fees necessary for the installation of the BMCS. Obtain and pay for all inspections required by all laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspection, and file such certificates with Owner.

E. BMCS work shall be furnished and installed by the temperature control system manufacturer complete with all required conduit and wire. Installation of conduit, wiring and wiring devices shall be done in accordance with the provisions of Division 16, Electrical Work. BMCS work shall be performed by skilled mechanics under the direction of experienced engineers, all of whom shall be properly trained and qualified for BMCS work.

F. Control system and components shall be web-based, TCP-IP protocol requiring only an internet browser to access and control or modify the system

G. Network and all controllers to be native BACNET.

1.02 WORK REQUIRED:

A. All engineering design, labor, materials, equipment and services necessary for and reasonably incidental to proper completion of BMCS work as shown or herein specified (excepting only work or materials specified or noted as being done or furnished by others), consisting in general of the following, complete and ready for operation.

1. Central Control.
2. Input/Output Panel (IOP's).
3. Software Packages.
4. Remote Control, alarm and sensing devices.
5. Fire Alarm System Interconnects.
6. Complete wiring network interconnecting all parts of the system.
7. Instruction of Owner's operating personnel.

1.03 DRAWINGS:

A. The drawings are diagrammatic in general: Drawings indicate generally the locations of component parts of the system but are not intended to show all fittings or all details of the work.

B. However, follow the drawings as closely as possible, checking all dimensions against conditions existing at the building.

1.04 APPLICABLE CODES AND STANDARDS:

A. Systems and equipment installed under this Section shall comply with the current editions of the following codes and standards:

1. Local Building Code.
2. NFPA 70: National Electrical Code.

1.05 WORKMANSHIP:

A. Do all work in a neat and first-class manner. If so directed by Architect, remove and replace any item of work not done so as to present an orderly, neat, and workmanlike appearance, provided that such item can be correctly installed by usual methods of the trade.

1.06 VISITING SITE:

A. Visit site of proposed work and become familiar with locations and various local conditions affecting proposed work. No additional allowance will be granted because of lack of knowledge of such conditions.

1.07 PROTECTION OF EQUIPMENT:

A. During construction all mechanical equipment shall be protected from damage caused by water, masonry, plaster, paint and job accidents.

1.08 EQUIPMENT SUPPORTS:

A. Provide all necessary grillage, angle iron, etc., required to support equipment.

1.09 INCIDENTAL WORK:

A. Setting sleeves and inserts and laying out and forming openings in walls and structural floors are included in this Section.

B. Cutting and patching and repairing of walls, floors, etc., are included in this Section. Architect's approval required before cutting any parts where strength or appearance of finished work is involved. Finish up in a neat and workmanlike manner to match existing work.

C. Repair pipe covering and duct insulation at points of connection to system.

1.10 CONTROL WIRING:

A. Include control and interlock wiring and power wiring for control panel in this Section. Install in conduit in accordance with provisions of NEC when exposed, concealed above in accessible ceilings or concealed in walls. Plenum rated cable may be used above accessible ceilings only (for plenum or non-plenum).

B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls and partitions.

C. Wire all devices individually to terminal strips in control panels.

D. Furnish necessary relays and auxiliary contactors and other accessories required. Provide interlock relays per NEC. Coordinate start-stop stations, auxiliary contacts, etc., with starters.

1.11 PAINTING:

A. Finished equipment which has had finish damaged during construction shall be refinished to new condition.

1.12 MATERIALS, GENERAL:

A. Use standard components, regularly manufactured and not custom designed for project. Use systems and components proven in use.

B. System shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.

C. Provide all necessary relays and contactors, auxiliary contacts and other items required to perform the functions specified herein.

1.13 SUBMITTALS:

A. Submittal contents shall include the following:

1. Trunk cable schematic showing Input/Output Panel (IOP) locations, and all trunk data and intercom conductors.
2. List of connected data points, including IOP's to which they are connected, and input device (sensor, etc.).
3. Sketches of system showing all monitored systems, point addresses, and operator notations.
4. BMCS central system configuration complete with all peripheral devices, batteries, power supplies, diagrams, etc., with interconnection diagrams.
5. Technical specification data sheets for each system component and device.

6. Descriptive data and sequence of operation of all operating, user, and application software including complete Operator's Manual and Programmer's Manual tailored to the job.

1.14 OPERATOR INSTRUCTION:

A. Conduct operator training on the system installed in building. Training shall include a minimum of Two (2) 4 hour dedicated courses. Classes are to be provided in segments taken at the owner's discretion, either consecutively or intermittently.

B. Schedule training at Owner's request.

1.15 DOCUMENTATION:

A. Provide six (6) sets of complete system documentation at acceptance time as specified. Include the following:

1. Data specified in the SUBMITTALS Section in its final as-built approved form.
2. As-Built interconnection wiring diagrams, or wire lists, of the complete field installed system with complete, properly identified ordering number of each system component and device.
3. Operator's Manual.

1.16 ACCEPTANCE PROCEDURE:

A. Submittal data relevant to point index, function, limits, sequences, interlocks, power fail-restart, logs, software routines and associates parameters, and other pertinent information for the operating system and data base shall be forwarded to the Owner's authorized representative. Approved software packages shall be entered into the central computer and debugged. Prior to full operation, a complete demonstration and readout of the computer real-time responsibilities of surveillance, and command shall be performed in the presence of the Owner's authorized representative, and the Engineers.

This demonstration may also involve temporary alteration of data values to determine software response to certain conditions, and changes to system clock to test time dependent functions. This demonstration shall, with the Owner's authorized representatives' written acceptance, allow commissioning of the computer for on-line operation.

B. Warranties (See General Conditions) shall apply to software as well as to hardware and workmanship.

PART 2 PRODUCTS

2.01 GENERAL:

A. Furnish and install a complete Building Management and Temperature Control System (BMCS). The Facilities management system shall consist of a network of various independent Stand-Alone Digital Controllers (SDC), together with a Centralized Host Station (CHS) (PC), as specified to provide centralized access and facility wide control functions. The SDC's shall be interconnected in a communicating network to provide facility wide access and sharing of information. A Local Area Network (LAN) shall be provided to interconnect SDC's for high-speed data transmission. Provide web server and native BACNET devices and protocols.

B. Provide two copies of all software required for system operation/control.

2.02 LOCAL AREA NETWORK (BACNET):

A. The LAN shall be a peer-to-peer, token passing network, using packetized transmissions, CRC 16 error checking and distribution error recovery. Single or multiple SCD failures shall not cause loss of communications. Communications shall be sustained as long as there are at least two (2) operational SDC's on any segment of the LAN.

B. LAN connected SDC's shall be provided with a communications watchdog to assure that an individual SDC cannot permanently occupy the LAN. If an SDC is determined to be monopolizing communications, it shall be automatically shutdown and an exception reported to annunciate this fact.

C. Network shall be BACNET based protocol.

2.03 BUILDING MANAGEMENT AND CONTROL SYSTEM (BMCS) PERFORMANCE REQUIREMENTS:

A. This section shall describe the minimum hardware requirements for the Stand-Along Digital Controllers (SDC's) and the Centralized Host Station (CHS), as well as the overall performance requirement for BMCS.

B. The BMCS shall support CHS as specified. Each CHS shall provide operator access to the entire network of SDC's.

2.04 WEB SERVER OPERATOR INTERFACE:

Furnish a Web Server to allow daily operations functions to be accomplished from any network connected web browser.

A. Operators shall be able to utilize any commercially available browser such as Microsoft Internet Explorer. No additional software shall have to be installed on the client PC for normal operation of the system.

B. All communications between the web browser and web server shall be encrypted using 128 bit SSL encryption.

C. Web server shall be able to be located on the owners Intranet or on the Internet.

D. Web server shall have the ability to automatically obtain an IP (Internet Protocol) address using DHCP. Use of static IP addressing shall also be supported.

E. Any unlimited number of users shall be able to access the web server.

F. BACnet. The Web Server shall support the BACnet Interoperable Building Blocks (BIBBS) for Read (Initiate) and Write (Execute) Services.

G. The Web browser client shall support Sun Microsystems Java 2 (JRE 1.4.0 or higher) plug-in.

H. Functionality:

1 Operators shall be required to enter in a valid user name and password to access the system. The view of the system provided for the user will be customized based on user identity.

2 Operator security. Each operator shall be able to be assigned a unique user name and password. Users shall be assigned to view, view and edit or administrative capability.

3 The web server shall display the same graphics that have been created for the Operators Workstation. Graphics shall be able to contain both static information such as floorplans, equipment schematics, etc. as well as dynamic information including space temperatures, setpoints, equipment status etc.

4 All dynamic values shall be automatically refreshed every 10 seconds. The refresh of dynamic data shall not require a refresh of the static information on the graphic.

5 Operators with proper security shall be able to override setpoints and equipment operation.

6 System schedules shall be easily selected for display. Operators with valid security shall be allowed to make changes to schedules including modifications to start and stop times and creating exception days. These changes shall be made graphically within the web browser.

7 A log of system alarms and events shall be able to be viewed from the web browser. Operators with proper security shall be able to acknowledge alarms.

8 System trends shall be able to be selected and viewed. Trends shall be shown graphically with the proper axis scaling automatically selected.

9 Operators with proper access shall be able to configure the web server using their web browser.

10 All user entered information (web pages, security, etc.) shall be stored in non-volatile memory. System operational information and clock functions shall be backed up by battery or other device for a minimum of 72 hours.

2.05 SDC HARDWARE REQUIREMENTS:

A. Stand-alone Digital Controllers shall be 16-bit microcomputer based, providing a multi-tasking operating system for control functions simultaneous with all other facility management, operator interface, and system communications functions.

B. SDC's shall provide true floating point arithmetic calculations. To accommodate accumulation of large totalized values, the SDC shall support calculation and accumulation of values up to 10 to the thirty-eight power.

C. Application Program Protection:

1. All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database, shall be protected from loss due to power failure for a minimum of 10 months. Provide EE Prom nonvolatile memory for these functions.

2. Uninterruptible Power Source (U.P.S.): All □SDC panels shall be protected from power surge and power outage. Provide 5 minute full load runtime, 2 year warranty and $25,000 lifetime equipment protection. Provide protection for data and telecom lines. U.P.S. shall be equal to APC, □Smart-UPS 700.

D. Multi-tasking: SDC's shall provide the capability to simultaneously perform at least, but not limited to, the following functions.
   1. Downloading of application program changes to the SDC without affecting the simultaneous operation of existing operating application programming.
   2. Printing of scheduled or on-demand reports without preempting operator functions.

2.06 CHS PERFORMANCE REQUIREMENTS:

A. Color graphic Operator Interface: Color graphics shall be submitted for approval by the Engineer. Each color graphic terminal shall be driven by software allowing the operator to access any system information via a "system penetration" method. System penetration shall allow the operator to begin at an entire site plan color graphic display and progressively select portions of the site plan to be chosen for closer inspection or selection of a more detailed Color graphic display of a desired portion of the facility. The operator shall be able in this manner to "penetrate" to any desired system information without being required to enter any commands via the keyboard.

1. Provide overall graphic view of the entire facility's floor plan. Color code each space to indicate whether space setpoints (temperature and humidity) are satisfied or not. Use the following color scheme:
   Red: High limit
   Green: Satisfied
   Blue: Low limit

B. Accessible System Information: Available for display or modulation in any specific Color graphic display shall include, but not limited to:
   < the real-time value display of any connected point in the network of SDC's.
   < the alarm status condition of any desired system alarm point.
   < any software parameter such as setpoints for control sequences, minimum position adjustments, or throttling ranges.
   < Provide air and water systems flow diagrams for all AC units, ERU, Terminal Boxes, Exhaust Fans, Chiller, Towers, Boilers, Pumps and piping.

C. Centralized Scheduling and Modification: Each CHS Color graphic terminal shall support operator access to the Global Scheduling Screens which allow the operator to review and modify any or all BMCS schedules as desired. The Centralized Scheduling function shall allow modification of equipment and lighting operating schedules, modification of facility holiday schedules, and when desired allow assignment of temporary schedules for designated portions of the facility or specific equipment. Scheduling functions shall be either global or individual by equipment, as selected by the operator. Any scheduled event shall bring on all necessary equipment for proper operation.

D. Global Electrical Demand Limiting Control: CHS shall allow operator to review and modify the parameters affecting global demand controls strategies. Demand control shall utilize sliding window control algorithm with provisions for multiple load shed tables facility wide as appropriate to Owner's requirements. Time of Day demand limits shall be assignable to appropriate billing period time slots.

E. Energy Management Reporting:

1. CHS shall provide daily, weekly, monthly, yearly formatted reports of facility metered electrical consumption. Reports shall provide information as detailed as hourly KWH consumption, daily peak hour of consumption, daily time of peak demand, demand setpoint in use at time of peak, daily degree days, and outside air temperature and relative humidity at time of peak. Reports shall be created to provide individual reporting as desired by the Owner for multiple facility meters, multiple sites, or aggregate facility metering combining multiple meters.

2. CHS shall retain daily summary energy data for up to five (5) years. Reports can be designated as automatically printed, or called-up for report print out on demand.

3. CHS shall support auto dial polling of remote sites for individual energy reporting and histories of multiple sites. CHS provided shall have sufficient capacity to accommodate auto polling and report accumulation of at least 100 sites.

F. Optimum Start Control: CHS shall provide operator access to Optimum Start parameters for any designated items or equipment or commonly scheduled systems of equipment. Optimum Start programs shall be self-learning and shall adapt the algorithm parameters to the optimum values for each applied zone. Optimum start/stop shall, at a minimum, provide separate control outputs for heating, cooling, fan and ventilation control sub-systems to maximize energy efficiency.

G. Trend Reports:
   1. CHS shall supports logging and historical accumulation of treated data from the entire facility, or multiple sites as required. CHS shall include the capacity for acquiring trend data from at least 100 sites.
   2. CHS supplied with dedicated logging printers shall provide the capacity to document printed trend data accumulated from any or all of the SDC's in the connected on-site network, or from any number of remote sites which connect to the CHS dedicated logging printer via dial-up modem.
   3. CHS shall provide capacity to store to disk a directory of at least 150 trend logs. Such trend logs can be accessed from the directory by the operator at any time for analysis of selected sets of the trended data, display onto the screen, or hard copy documentation.
   4. All points listed in BMCS points list shall be trended in a rolling (2) two week log, accessible by the user upon command. Trends shall automatically graph specified points for the (2) two week period. Provide (30) thirty minute samples of each point.

H. Third Party Software Packaged: CHS shall provide the capacity to run specific third party software packages for word processing, spreadsheet, or database management programs. Use of third party software shall not suspend operation of background tasks of multi-tasking operating system, such as alarm logging, and report generation.

I. Graphic Chart Plotting and Bar Graph Software: Provide software to be integrated with CHS BMCS software which will enable the operator to command X-Y graphic plots of specific BMCS energy history data, or accumulated real-time system information. Software shall in addition provide bar charts of energy usage information, such as charts of daily peak demand, etc. All graphic plots and bar charts shall be screen printable onto CHS dot-matrix printer, or onto multi-pen plotter where available.

J. SDC Data Base Archiving: CHS shall provide capability to upload global control functions being performed by the network of SDC's, and the individual database and application programming resident in each SDC in the facility, or on remote sites. Unloaded programs shall be retained on
CHS hard disk for system backup. Programs may be modified using CHS Editor functions, and downloaded to individual SDC's as desired. Downloading of SDC databases shall not interrupt alarm reporting functions, or other multi-tasked functions which are ongoing.
   1. All individual sites/school must be programmed such that each site and panel can be individually archived and any uploading or downloading can be done per site and panel such that one site or panel will not prohibit another from being updated or archived.

K. BMCS Data Base Maintenance Reports: CHS shall provide a daily report of all modifications made to any software function in the BMCS. Report shall include the face that specific setpoints, schedules, sequence parameters, or limits were modified and the time and location of the modification, and the identification of the operator making the modification.

L. BMCS Overrides Report: CHS shall provide a daily report of all overrides issued, and all overrides in force on the BMCS. Overrides report shall allow tracking of operator functions and maintenance of desired operation conditions.
   1. Provide a history of equipment/system schedules being changed by user. The history shall include date and time that schedule was changed and who changed it (login name). The intent is to provide the user proof of schedule changes implemented, that have been requested by end user at site.

M. BMCS Maintenance Reports: CHS shall provide a weekly report of maintenance items on an automatic

printout basis. The maintenance report shall segregate maintenance items into four categories minimum. A "Fire Occurrence" report shall be generated for those items which have passed their maintenance limits within the past week. A "Pending" report shall be generated for those items which have been previously annunciated. An "Overdue" report shall be generated for those items which have exceeded their critical past due maintenance settings. A "Work Completed" report shall be generated for those items which have been entered as complete. Maintenance events shall be satiable by the user based on event, elapsed run time, number of cycles or calendar day/date.

2.07 BMCS PERFORMANCE REQUIREMENTS:

A. Automatic Temperature Control: The SDC's shall interface to additional panels of equipment as required to provide the performance specified for Control Panels.

B. Control Panel: Each control panel shall be a fully electronic analog control or digital control system, providing all control functions for the equipment specified to be controlled from that panel. Control functions to be performed by control panels are as described in this specification in the sequences of operation, in the point charts, and other relevant sections of these specifications. Every control panel shall be constructed and provided to perform the facilities management requirements of this specification.

C. Control Panel BMCS Functions:

1. It is the intent of this specification to provide the Owner with the ability to read out temperatures and other values, and to adjust specific items from localized, as well as centralized locations. In order to provide this capability, control panels are specified to be placed in specific locations with readout gauges and adjustments to be mounted directly in the control panel.
2. Every control panel shall provide readouts for the temperatures, or other information, specified. Every control panel shall provide adjustments for the setpoints, parameters, and other adjustment functions specified.

D. Read Out of Items:

1. Items specified for read out shall be under continuous display on the face of the panel with either a digital display or analog electronic meter. Read out of sensed variables used in control sequences shall be from the same sensors used for control. As an alternative, provide either a duplicate sensor for the read out, or provide a transducer for each sensed signal which can provide both a read out signal and a signal compatible with the controller.
2. Each read out items shall be individually named and labeled. Name label shall be directly adjacent to the actual display value of that item. Label shall be a part of the digital display of that value, or a Bakelite label mounted directly above the value display. Display readout requirements are in addition to capabilities provided by plug-in operator devices which are provided as part of digital controller-based systems.

E. Adjustments: Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all setpoints used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be integral to each control panel. For systems providing digital controllers, it shall not be necessary to carry or plug-in portable operators device to make these adjustments. The preferred method for adjustments is a dedicated adjustment pad, or individual adjustment potentiometer providing direct input to the affected loop controller or sequence controller.

F. Spare Point Capacity: Digital controller based control panel bids shall include in every panel, additional capacity for future installation of desired equipment at the Owners discretion. Provide expansion capacity of at least 10% for every panel. Expansion capacity shall include equal quantities of every point type; Analog input, Digital input, Digital output, and Analog output. Systems providing modulating outputs via pulse width modulation techniques, shall provide within each panel all the components required to implement the functions equivalent to an analog output.

G. Provide BMCS override of all points/equipment/systems upon loss of temperature or humidity sensor or other controlling setpoint. It is the intent ot give the user the ability to override any control input to force a temporary unit/equipment override from a remote location until they can dispatch service personnel to the site.

2.08 SENSING AND CONTROL OUTPUT REQUIREMENTS:

A. Sensing:

1. All sensing inputs shall be provided via industry standard signals. Temperatures, humidities, differential pressure signals and all other signal inputs shall be one (1) of the following types:

0-20 mA
4-20 mA
0-5 VDC
0-12 VDC
Resistance Signals

2. All signal inputs shall be compatible with the controllers used, and with the requirement for readout of variables as specified.

2.09 CONTROL OUTPUTS:

A. On/Off Outputs: Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting whether the 120 VAC circuit to the contactor is active. All such relays or digital output modules shall provide a pilot light or LED display of this same status.

B. Modulating Output:

1. Modulating outputs shall be industry standard 0-5 VDC, or 0-12 VDC. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.
2. All modulating outputs shall provide within the control panel, a metric gauge, or display indication of the commanded position signal to the actuating device. This meter, gauge or display must provide either a 0-100 percent position indication, or read out directly in the engineering units of the signal being used. Drive open/Drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.

C. Standard Software Function Libraries: All SDC's shall have a standard feature of their system software, complete libraries of control algorithms for DDC, Energy Management, and Building Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application programming of each individual SDC.

D. Application Software Documentation: Control shall provide a blueprint documentation of the software application program for each SDC. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. For systems utilizing program listings. A program listing shall be printed onto the same blueprint shall be stored and maintained in each SDC panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

E. Energy Management Control:

1. The network of SDC's shall individually perform Time of Day Scheduling, Optimum start/stop, Enthalpy optimization, and all control optimization strategies, such as Supply Air Reset and Soft Start Ramp-up, for their connected systems of equipment.
2. Coordination of strategies involving multiple systems of equipment shall be performed by sharing of necessary data between the SDC's on the communicating network.

2.10 FACILITY DIAGNOSTICS:

A. The BMCS shall provide diagnostic reports of the following types, for specific systems of equipment as specified:

B. Alarm Occurrence Status: When specified alarm conditions occur, provide a report printout listing the status of specific items associated with the equipment generating the alarm. Report shall be routed to a specific printer or combination of printers at the CHS' or CCS'. Report shall record the time the status information was taken, and shall allow operational personnel to use this information to diagnose the alarm situation.

C. Alarm Occurrence Development Report: For specific systems of equipment the BMCS shall record a continuous log of the values of selected variables. Upon occurrence of an alarm, or some specific combination of performance conditions, the report will be printed, showing the status of each of these variables for each of the 15 minutes immediately prior to the occurrence of the "triggering" condition.

D. BMCS Telecommunications Support: The entire BMCS network shall be able to share one or multiple auto dial auto answer modems for automatic dial out reporting of alarms, exceptions, and report information to any CHS or CCS via the dial up telephone network. Such CHS or CCS may be on remote sites, or on the same multiple building site connected by a private branch exchange system.

E. Off Hours Exception Reporting: The Owner shall specify up to five (5) sites to which off hours exceptions shall be auto-dialed and reported. This shall allow the Owner to assign off hours exception responses to various facility personnel as necessary. Selection of the site to be dialed can be programmed by the Owner, and set to change automatically per time of day and day of week.

F. Segregation of Information Reporting: The Owner shall be able to identify up to five (5) locations to which various BMCS reports are auto-dialed and reported.

G. System Support Inventory: Provide for purposes of system support, a complete set of Input/Output circuit boards sufficient to replace any failed input output point card in any configuration of control panel. These shall be kept on-site, and shall be available for immediately recovering from the loss of point processing capability in any control panel.

H. Diagnostic/Notification Modem: Provide an implement and auto-dial/auto-answer modem in the system of control panels for purposes of remote diagnostics and notification of desired exceptions and alarms. Dial up telephone line shall be provided by the Owner. Modem shall provide for the following functions:
   1. Access to the entire facility control system by the Contractor to provide service and diagnostic support.
   2. Access by the Owner from off-site for similar purposes, and for remote operation, monitoring, and adjustment of facility functions.
   3. Auto-dial out of desired exceptions to a remote site, or to an Owner specified set of phone numbers for business-hours, or off-hours reporting.

2.11 DISTRIBUTED ACCESS:

A. It is the intent of this specification to provide the Owner with BMCS information at distributed locations through the facility.

B. Multi-user:
   1. Distributed Access-at every panel.
   2. Distributed Documentation.
   3. Historical Documentation logging-printer of disk for exceptions.
   4. Facility-wide access - LAN connected SDC□s.
   5. Facility Operation Documentation.
      a. Overrides logging-CRT in specific locations.
      b. System log-on documentation.
      c. System database modification documentation.
      d. Local historical alarm documentation.

C. Distributed Access: SDC's shall include integral operator devices with full alphanumeric display and a keypad for password controlled access to various levels of operational capability, from simple information access, to full programmability of SDC functions.

D. Facility Wide Access: LAN connected SDC's shall provide facility wide access to locally connected operators. Access shall be supported both via the integral operator device and through locally connected VT-100 compatible CRT's.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Control diagrams on drawings and/or Control Sequences are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown.

B. Installation shall be in accordance with manufacturers recommendations.

C. Coordinate the required dedicated telephone line provided by the Owner for BMCS use.

END OF SECTION

PART ONE – GENERAL

1.01 DESCRIPTION OF WORK

A. Minimum standard of forms for performing testing of electrical equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 26 0500 – Common work results for Electrical

1.03 RELATED DOCUMENTS

A. NFPA 70B – Annex F, Forms

PART TWO – PRODUCTS

Not Applicable

PART THREE – EXCECUTION

3.01 TESTING FORMS - PROVIDED

A. Feeder Megger© Test Report Form

B. Driven Ground Test Report

These forms are made available as a minimum standard. Others may be used as long as they meet the general intent.

3.02 Testing Forms – Referenced

A. Cable Test Form (Refer to NFPA 70B, Form F.27).

B. Insulation Resistance Test Form (Refer to NFPA 70B, Form F.28).

Feeder Megger© Test Report

Electrical Contractor:______________________________ Sheet:________of___________

Business Address:____

City:______________________________ State:_________ Zip Code:____________________

Date of Measurement:________________ Temp/Humidity:________/_____________

Type of Meter and Model Number:____________________/_________________________

From	**To**	**Feeder Length**	**Phase A Reading**	**Phase B Reading**	**Phase C Reading**	**Phase N Reading**
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	
Feeder Size:					Insulation:	

Grounding System Resistance Test

Sheet No. _____ of _____

Project _____ Project No._____ Date _____

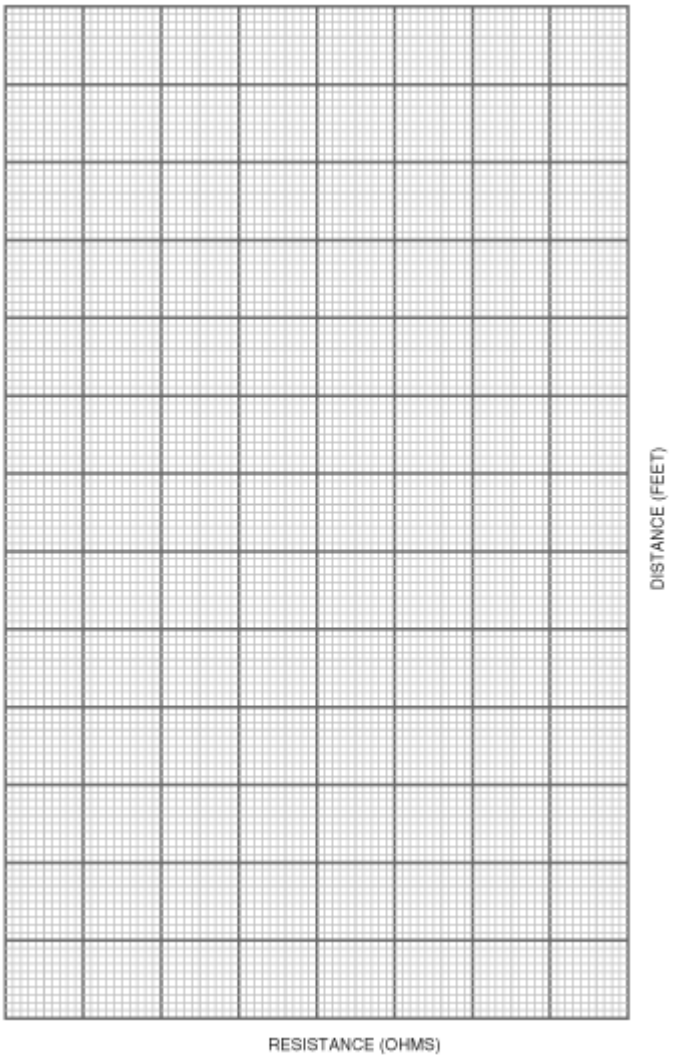
Contractor_____ Air Temp _____ Rel. Humidity _____

Location:_____

Season	
Soil Type	
Soil Condition	
Single Rod Depth	
Multiple Rods (Y/N)	
Longest Dimension	
Buried Wire/Strips (Y/N)	
Longest Dimension	
Dist. to Aux. Electrode	
Other	

AUXILIARY POTENTIAL ELECTRODE

Distance (FT)	Resistance (Ohms)



Remarks: _____

Test Equipment: _____ Serial #: _____

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SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The "General Conditions" and "Special Conditions" of Contract as written and referred to hereinbefore are adopted and made part of Division 26.

1.02 DESCRIPTION OF WORK

A. Provide equipment, labor, etc., required to install complete working electrical system as shown and specified.

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings or in specifications, as though specified by both.

D. All equipment and wiring shall be new.

E. Electrical work includes, but is not limited to:
   1. Arrange with local utility companies for services as shown or specified.
   2. Removal or relocation of electrical services located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
   3. Alterations and additions to existing electrical systems.
   4. Complete 600-volt Distribution System. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
   5. Complete raceway systems for the following systems as described in Division 27. Provide cabling and equipment as specified for each system as described in the applicable Section and/or on the Drawings.
      a. Voice and Data.
      b. Rescue assistance signal systems.
   6. Complete raceway systems for the following systems as described in Division 28. Provide cabling and equipment as specified for each system as described in the applicable Section and/or on the Drawings.
      a. Access control.
      b. Security access detection equipment.
   7. Connection of all appliances and equipment.
   8. Complete Primary Distribution System; provide meters, switchgear, fuses, cable and other equipment forming a complete system.
   9. Complete emergency lighting and power system, including individual battery units and/or inverters.
   10. Complete fire alarm system as described in Division 28.
   11. Complete lighting systems.
   12. Provide temporary facilities for construction power.
   13. Coordination with general contractor for access panels in hard ceilings or walls required for access to Division 26 components.

1.03 WORK NOT INCLUDED

A. Furring for conduit and equipment.

B. Finish painting of conduit and equipment.

C. Installation of motors except where specifically noted.

D. Control wiring for mechanical systems, except where indicated to be provided by Electrical Contractor.

E. Installation of telephone instruments.

F. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

G. Active network devices including switches and transceivers, wireless activation point devices unless specifically noted in the Contract Documents.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Classification of excavation: Architectural Division.

B. Painting: Painting Division.

C. Concrete Work: Concrete Division.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.

B. Install work under this Division per drawings, specifications, latest edition of the National Electrical Code, Local Building Codes, and any special codes having jurisdiction over specific portions within complete installation. In event of conflict, install work per most stringent code requirements determined by Architect.

C. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Architect Certificates of Inspection and approval issued by authorities.

1.06 QUALIFICATIONS OF CONTRACTOR

A. Has completed minimum two projects same size and scope in past five (5) years.

B. This qualification applies to Sub-Contractors.

C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.

D. Owner reserves right to reject bid of any Contractor failing to meet these qualifications.

E. Licensed and bonded in state where project is located.

1.07 GENERAL JOB REQUIREMENTS

A. Drawings and Specifications:
   1. Electrical work is shown on E series drawings inclusive. Additional electrical work may be shown on T, AV, or FA series of drawings where included in set. Follow any supplementary drawings as though listed above.
   2. Drawings show general run of circuits and approximate location of equipment. Right is reserved to change location of equipment and devices, and routing of conduits to a reasonable extent, without extra cost to Owner.
   3. Refer conflicts between drawings and specifications describing electrical work and work under other Divisions to Architect for remedial action.
   4. Use dimensions in figures in preference to scaled dimensions. Do not scale drawings for exact sizes or locations.
   5. Execution of Contract is evidence that Contractor has examined all drawings and specifications related to work and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
   6. Charges for extra work not allowed unless work authorized by written order from Architect approving charge for work.

B. Specifications and Drawings:

1. Specifications and Drawings shall be complementary and be used for the complete interpretation of the electrical work.
2. Unless noted or modified by specific notation to the contrary, the indication and/or description of any electrical item in the documents carries with it the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated. The use of the words “furnish” or “provide” with the absence of the word “install” shall be defined to include the installation and connection of the equipment and/or materials unless specific instructions are included for others to install and/or connect.
3. No exclusion from or limitation in drawings or specifications for the electrical work shall be reason for omitting the appurtenances, accessories, or devices necessary to complete any required system or item of equipment or compliance with codes.
4. The drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of the materials and equipment. Wherever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect before proceeding with the work.

C. Visit to Site:
1. Visit site to survey existing conditions affecting work. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration given to future claims due to existing conditions.

D. Definitions:
1. Provide: Furnish, install and connect complete.
2. Wire: Furnish all necessary wiring and connect complete.
3. Install: Set in place and wire complete.
4. Work: Materials completely installed and connected.
5. AWG: American Wire Gage.
6. NEC: National Electrical Code (latest edition)
7. NFPA: National Fire Protection Association.
8. OSHA: Occupation Safety and Health Administration.
9. UL: Underwriters Laboratories, Inc.
10. NEMA: National Electrical Manufacturers Association.
11. IEEE: Institute of Electrical and Electronic Engineers.

E. Workmanship, Guarantee and Approval:
1. Work under this Division shall be first class with emphasis on neatness and workmanship.
2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Architect's constant observation, final approval, and acceptance. Architect may reject unsuitable work.
3. Furnish Architect written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
4. In event that project is occupied, or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or item of equipment is accepted by Owner.

F. Observations of Work and Demonstration of Operation:
1. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for check. Provide sufficient personnel to expedite cover removal and replacement.
2. Contractor to assist Architect in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manufacturer available for demonstration of systems where requested by Owner.

G. Testing of Electrical Systems:

1. Test Completed work as follows:
    a. Perform tests required by Architect to indicate compliance with specifications, drawings and applicable codes. Provide instruments, labor and materials for tests.
    b. Refer to other Division 26 specification sections for additional testing requirements.

H. Materials and Substitutions:
1. All material shall be new, with U.L. label where available. If U.L. label is not available, material shall be manufactured in accordance with applicable NEMA; IEEE and Federal Standards.
2. No material shall be substituted for specified, except by prior written approval of Architect. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material given consideration only if adequate comparison data including samples are provided. Approval required prior to bid date. Bid substituted material only if approved in writing by Architect.
3. Submit to Architect within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Approval of manufacturer on list does not constitute approval of specific material or equipment.

I. Shop and Erection Drawings:
1. Submit complete shop drawings for all material and equipment furnished under Division 26 and where applicable 27, and 28 of specifications. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission, if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Architect/Contractor. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Architect. Shop drawings and submittals shall bear the stamp of approval of the Electrical and General Contractor as evidence drawings have been checked by them. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.
2. See 013000 - Administrative Requirements
3. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Architect in writing of equipment differing from that shown.
4. Prepare erection drawings when required by Architect. Investigate thoroughly all conditions affecting work and indicate on drawing. Architect will review erection drawings before work commences.
5. Coordination shop drawings will be required for the following areas, drawn to a scale of not smaller than 1/4" - 1'-0":
    a. Electrical equipment rooms and areas.
    b. Electrical and mechanical equipment areas.
    c. Start drawings as HVAC shop drawings indicating all ductwork piping, equipment and locations of mechanical room floor drains, and electrical connections. Indicate elevations of all ductwork and piping. Draw sections as required to clarify congested situations.
    d. Next, the Plumbing Section shall add all piping and plumbing equipment to the drawings.
    e. Next, the Fire Protection Section shall add all sprinkler heads and fire protection piping.
    f. Next, the Electrical Sections shall add all electrical fixtures, conduit and equipment.
    g. Next, the drawings shall be submitted to the General Contractor for final coordination.
    h. Finally, after the General Contractor has approved the drawings, they shall be submitted to the Architect for approval.
    i. Finally, after the General Contractor has approved the drawings, they shall be submitted to the Engineer for approval.

J. Cooperation:
1. Carefully coordinate work with other contractors. Refer conflicts between trades to Architect.

2. Arrange and coordinate work to avoid conflict with trades to allow for accessibility, conserve space and to provide for maintenance.
3. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor and/or Architect.

K. Maintenance and Operating Instructions for Equipment:
1. Submit to Architect one (1) set of data prepared by manufacturer for each item of electrical equipment completely describing equipment. Data to include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures and other literature required for maintenance of equipment. Bind in booklet form for presentation.

L. "Record" Drawings:
1. Provide "Record" prints at the completion of job. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Indicate actual location of conduit systems, outlets, and equipment. Turn over prints to Architect at final observation.
2. Provide as built drawings created from record drawings.

M. Items for Owner:
1. Provide following items for Owner at time of substantial completion:
a. Certificates of inspection and approval from authorities having jurisdiction.
b. Written guarantees.
c. As built drawings.
d. Final approved shop drawings (1 set).
e. Spare fuses (furnish receipt).
f. Maintenance data (1 set).
g. Affidavit of Owner Instruction (1 copy).

N. Protection and Storage:
1. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.
2. Do not leave exposed or unprotected, electrical items carrying current. Protect personnel from exposure to contact with electricity.
3. Protect work and materials from damage by weather, entrance of water or dirt. Cap conduit during installation.
4. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.
5. Exercise particular care when working around telephone (electronic) equipment to prevent entrance of dust, moisture and debris into the equipment. Provide dust barriers and partitions as required.
6. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Storage space on site and in building designated by Owner/Architect.
7. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations, deferred to Architect.

O. Excavation and Backfill:
1. Excavate for work in this Division.
2. Avoid existing facilities in excavating. Contractor is responsible for repair and replacement of damaged facilities in executing work.
3. Backfill in twelve-inch (12") lifts, wetted down and tamped. Compaction minimum 95% of adjacent earth.
4. Repairing to be comparable to work cut including new asphalt paving, concrete paving, sod, replanting shrubbery, etc. Architect will observe repair work and reject unsuitable work.

P. Cutting and Repairing:
   1. Cut and repair walls, floors, roof, etc., required to install work. Where work cut is finished, employ original installer of finish to repair finish. Do not cut structural members.

Q. Anchors:
   1. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable. Protect telephone equipment from drilling residue.

R. Cleaning and Painting:
   1. Clean equipment furnished in this Division after completion of work.
   2. Touch-up or re-paint damaged painted finishes.
   3. Remove debris, packing cartons, scrap, etc., from site.

S. Starters:
   1. Separately mounted starters are furnished under another Division but installed in Division 26 unless specifically noted otherwise.

T. Control Wiring:
   1. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under another Division, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

U. Code Compliance:
   1. Entire electrical installation shall comply with all aspects of code including local interpretations. This includes but is not limited to:
      a. Installation adjustment to meet all code clearances between electrical such as ductwork, other HVAC, plumbing, fire protection, and structural systems.
      b. Locations for items such as fire alarm appliances, exit lights, egress lighting, disconnect switches, etc.

1.08 GENERAL JOB REQUIREMENTS

A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered unless explicitly stated otherwise by the Electrical Engineer. Where several manufacturers are named, only the named manufacturers' products will be considered, and the Contractor's bid shall be based on their product.

B. Where the phrase "OR APPROVED EQUIVALENT" or "OR EQUIVALENT" or "EQUIVALENT TO" or "ACCEPTED SUBSTITUTE" is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equivalent to that of materials named in the opinion of the Electrical Engineer; However, such unnamed manufacturers' products will be considered as substitutions and shall not be used as a basis for bidding.

C. Basis of quality shall include material, workmanship, weight, finishes and gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.

D. Furnish standard products and manufacturers regularly engaged in production of such equipment.

E. Furnish manufacturer's latest standard design.

F. All materials and equipment shall have manufacturer standard warranty unless indicated otherwise.

G. All equipment shall conform to applicable IEEE, UL, ANSI and/or NEMA Standards.

H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests and pre-service checks, and then ensure all have been performed prior to completion of work.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION 260500

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SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Before new work begins, the Contractor shall determine and document in writing to Architect the operational status of existing electrical and communications systems to remain in service. After new work begins, existing electrical or communications systems found to be inoperative, and not documented in writing to Architect, shall be repaired or replaced by Contractor at no addition cost to the Owner.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

D. Demolition drawings are based on casual field observation.

E. Report discrepancies to Architect before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions.

G. Coordinate demolition of electrical systems with other Disciplines' Drawings and existing conditions. Remove systems as noted or affected by other demolition. Notify Dewberry Engineers, Inc. of any conflict or requirement that may affect the Electrical Work. Perform demolition work to avoid damage to existing systems to remain. Protect materials and equipment that are to remain within areas affected by demolition.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain written permission from Owner at least 10 days before partially or completely disabling system.
   2. Include schedule of work to be performed and time required to accomplish work request for interruption.
   3. Work during interruptions may occur after normal working hours. Include premium (overtime) time labor in bid.
   4. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.

3. Make notifications at least 24 hours in advance.
4. Make temporary connections to maintain service in areas adjacent to work area.
5. If the fire alarm is disabled for over 4 hours provide a fire watch per AHJ's direction.

F. Existing Telephone System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
1. Notify Owner at least 24 hours before partially or completely disabling system.
2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
3. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing voice and data: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
1. Notify telephone utility at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Re-label any abandoned circuit breakers or disconnect switches as "spare" and switch to "off" position.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and patch surfaces.

F. Cut off conduits concealed in slab two inches below top of base floor slab and patch slab or floor to match existing.

G. Leave existing branch circuits and feeders which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted.

H. Repair, re-terminate, re-support, etc. any damaged circuits.

I. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

J. Abandon outlets in existing masonry walls: Remove plaster frames, fill outlet box with grout and patch finish to match existing wall. Cut off conduits at wall where stubbed-out in furred ceiling space.

K. Disconnect and remove abandoned panelboards and distribution equipment.

L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

M. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

N. Repair adjacent construction and finishes damaged during demolition and extension work.

O. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

P. Extend existing installations using materials and methods compatible with existing electrical installations.

3.04 USE OF EXISTING A.C. OUTLETS

A. It is imperative only AC outlets located in building walls and columns be used for electrical tools, cleaning equipment, etc. AC outlets installed for telephone or electronic equipment to be used for that equipment only.

3.05 CLEANING AND REPAIR

A. General Contractor shall do all cutting and repairing of walls, floors, roof, etc., required for installation of work installed in this Division but shall back charge the Electrical Contractor for this work. Advise General Contractor of amount and nature of cutting and repairing necessary to install work prior to bid date.

B. Do not pierce exterior walls below grade with hanger bolts. Do not cut building structural members except as approved by Architect. Architect must approve cutting methods.

C. Clean and repair existing materials and equipment that remain or that are to be reused.

D. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide new typed circuit directory showing revised circuiting arrangement.

E. Luminaires: Remove existing luminaires being reused for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps lenses, ballasts, and broken electrical parts when indicated on drawings

F. Repair work comparable with work cut. New finishes shall match adjacent finishes. Architect will approve repaired work and may reject unsuitable work.

3.06 SALVAGE

A. Electrical equipment, wiring, etc., removed and not required to be part of new electrical installation is classed as salvage.

B. Salvageable equipment remains property of Owner. Store at site and/or within building as directed by Owner.

C. All materials, Equipment, and conductors indicated for demolition or removal shall be salvaged. Owner retains rights of ownership and first right of refusal of all salvage. The contractor shall remove from site and dispose of salvage not claimed by Owner.

END OF SECTION 260505

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SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Armored cable.

C. Metal-clad cable.

D. Wiring connectors.

E. Electrical tape.

F. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 260505-Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

B. Section 260526-Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 260553-Identification for Electrical Systems: Identification products and requirements.

D. Section 262100-Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

E. Section 284600-Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

F. FM 3971 - Fire Protective Coatings and Wraps for Grouped Cables; 2019.

G. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); 2008a (Validated 2019).

H. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).

I. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

K. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 79 - Electrical Standard for Industrial Machinery; 2021.

P. UL 4 - Armored Cable; Current Edition, Including All Revisions.

Q. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

R. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

S. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.

T. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

U. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

V. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

W. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

X. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

Y. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

Z. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Dewberry Engineers, Inc. and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.
   1. Where not otherwise restricted, may be used:
      a. For overhead service drop, installed in raceway to service head.
      b. For underground service entrance, installed in raceway.

F. Armored cable is permitted as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet (1.8 m).
      b. Where concealed in hollow stud walls, above accessible ceilings, or under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Where not approved for use by the authority having jurisdiction.
      b. Where exposed to view except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
      c. Where exposed to damage.
      d. For damp, wet, or corrosive locations.
      e. For isolated ground circuits.

G. Metal-clad cable is permitted as follows:
   1. Where not otherwise restricted, may be used:
      a. Concealed Lighting Branch Circuits: Type MC Cable, #12 AWG, Copper conductor, 90C insulation. May be used for connecting light fixture together. Maximum length is 15'. All home runs to first light fixture and switch legs shall be in conduit. Do not use for receptacle or other power circuits.
      b. Concealed Receptacle Branch Circuits: Type MC cable, #12 AWG, copper conductors, 90C insulation. May be used for connecting general purpose receptacles within a single room where concealed in gypsum board walls. All home runs to first junction box and between junction boxes or receptacle within room shall be in conduit. Do not use in masonry wall construction or for dedicated receptacles or other power circuits.
   2. In addition to other applicable restrictions, may not be used:
      a. Where not approved for use by the authority having jurisdiction.
      b. Where exposed to view except in dedicated electrical, communications, and mechanical rooms where not subject to damage.

c. Where exposed to damage.
d. For damp, wet, or corrosive locations.
e. For isolated ground circuits.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide conductors and cables with lead content less than 300 parts per million.

D. Provide new conductors and cables manufactured not more than one year prior to installation.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F. Comply with NEMA WC 70.

G. Comply with FS A-A-59544 where applicable.

H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

J. Conductors for Grounding and Bonding: Also comply with Section 260526.

K. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

L. Conductor Material:
1. Provide copper conductors only unless specifically allowed elsewhere in these specifications.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

M. Minimum Conductor Size: 12 AWG
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG , for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

O. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White with stripe to match phase color code above.
b. Equipment Ground, All Systems: Green.
c. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC.
      b. Encore Wire Corporation.
      c. General Cable Technologies Corporation: www.generalcable.com/#sle.
      d. Service Wire Co: www.servicewire.com/#sle.
      e. Southwire Company.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2 except as indicated below:
      a. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 ARMORED CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc.
   2. Encore Wire Corporation.
   3. Southwire Company.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.

2.05 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc.
   2. Encore Wire Corporation.
   3. Service Wire Co: www.servicewire.com/#sle.
   4. Southwire Company.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569 and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN/THWN or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Provide dedicated neutral conductor for each phase conductor.

H. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Aluminum or steel, interlocked tape.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.06 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M.
      b. Ideal Industries, Inc.
      c. NSI Industries LLC.

H. Mechanical Connectors: Provide bolted type.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ilsco.
      c. Thomas & Betts Corporation.

I. Compression Connectors: Provide circumferential type crimp configuration.

1. Manufacturers:
    a. Burndy LLC: www.burndy.com/#sle.
    b. Ilsco: www.ilsco.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.07 ACCESSORIES

A. Electrical Tape:
    1. Manufacturers:
        a. 3M.
        b. Plymouth Rubber Europa.
    2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
    3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 8.5 mil (0.21 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
    4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
    5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
    6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Cable Ties: Material and tensile strength rating suitable for application.
    1. Manufacturers:
        a. Burndy LLC.

C. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
    1. Products:
        a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
        b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

D. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
    1. Products:
        a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft (3.0 m)10 ft (3.0 m) of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors in single phase branch circuits in the same raceway is not permitted.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install armored cable (Type AC) in accordance with NECA 120.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
   2. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors or electrical tape.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering Including motor leads first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors or electrical tape.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Identify conductors and cables in accordance with Section 260553.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in other Sections.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

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SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553-Identification for Electrical Systems: Identification products and requirements.

C. Section 265600-Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2017.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Dewberry Engineers, Inc. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s): Chemically Enhanced Ground; Ground Plate:
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 fee (3.0 m) from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
      d. Provide ground enhancement material around electrode where indicated.
      e. Provide ground access well for first connected electrode.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4 by 4 by 12 inches (6 by 100 by 300 mm) unless otherwise indicated or required.
    b. Where ground bar location is not indicated, located in accessible location as near as possible to service disconnect enclosure.
    c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

I. Isolated Ground System:
   1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
   2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
   3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

J. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
   2. Provide bonding jumper in raceway from building grounding electrode system to each communications room and provide ground bar for termination.
      a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
      b. Raceway Size: 3/4-inch (21 mm) trade size unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 4 by 12 inches (6 by 100 by 300 mm) unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

K. Pole-Mounted Luminaires: Also comply with Section 265600.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).
   2. Factory Prefabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
      a. Exceptions:
         1) Use exothermic welded connection for connections to building frame.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Advanced Lightning Technology (ALT).
      b. Burndy LLC.
      c. Harger Lightning & Grounding.
      d. nVent ERICO: www.nvent.com/#sle.
      e. Thomas & Betts Corporation.
   5. Manufacturers - Exothermic Welded Connections:
      a. Burndy LLC.

b. nVent ERICO; Cadweld: www.nvent.com/#sle.
c. ThermOweld, a brand of Continental Industries, Inc.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
a. Advanced Lightning Technology (ALT).
b. Harger Lightning & Grounding.
c. nVent ERICO: www.nvent.com/#sle.
d. ThermOweld, a brand of Continental Industries, Inc.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4-inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet (3.0 m) are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
a. Advanced Lightning Technology (ALT).
b. Galvan Industries, Inc.
c. Harger Lightning & Grounding.
d. nVent ERICO: www.nvent.com/#sle.

F. Oxide Inhibiting Compound: Comply with Section 260518.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

F. Provide grounding bushings at metallic conduit terminations at metallic equipment/enclosures in the following locations:
1. All circuits over 250 Volts to ground (regardless of ampacity size and regardless of knockout method.
2. At any location where a loosely jointed metal raceway is encountered. Electrical Contractor shall make connection and repair loose connection where possible.
3. All hazardous classified locations. See NEC 250.100.
4. All circuits not less than 100 Amps (regardless of voltage).
5. All service entrance conduit.
6. All fittings, bushings, raceway, etc. shall be listed for the purpose.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 260526

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

B. Construction requirements for concrete bases.

1.02 RELATED REQUIREMENTS

A. Section 260533.13-Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16-Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 265100-Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 265600-Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from the contract documents in writing. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field Welding.

D. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Manufacturer's Requirement.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported plus 25% growth with a minimum safety factor of (2). Where this determination results in a load of less than 200 lbs., increase the strength until there is a minimum of 200 lbs. safety. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap. or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:

a. ABB: www.electrification.us.abb.com/#sle.
b. Eaton Corporation: www.eaton.com/#sle.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
e. nVent; Caddy: www.nvent.com/#sle.

2. Conduit Straps: One-hole or two-hole type; steel.
3. Conduit Clamps: Bolted type unless otherwise indicated.
4. Products:
   a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
   b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
   c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
   d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
   e. nVent; Caddy: www.nvent.com/#sle.

D. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Electrical Equipment Supports: 1/2-inch (13mm) diameter.
   b. Busway Supports: 1/2-inch (13mm) diameter.
   c. Single Conduit up to 1-inch (27mm) Trade Size; 1/4-inch (6mm) diameter.
   d. Single Conduit Larger than 1-inch (27mm) Trade size: 3/8-inch (10mm) diameter.
   e. Trapeze Support for Multiple Conduits: 3/8-inch (10mm) diameter.
   f. Outlet Boxes: 1/4-inch (6mm) diameter.
   g. Luminaires: 1/4-inch (6mm) diameter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Dewberry Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Dewberry Engineers, Inc., do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Dewberry Engineers, Inc.

H. Field Welding, Where Approved by Dewberry Engineers, Inc.

I. Equipment Support and Attachment:
   1. Use metal, fabricated supports, and/or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch (100mm) high concrete pad.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

K. Box Support and Attachment: See Section2605433.16 for additional requirements.

L. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

M. Exterior Luminaire Support and Attachment: See Section 265600 for additional requirements.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners in accordance with manufacturer's recommended torque settings.

P. Remove temporary supports.

Q. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquid tight flexible metal conduit (LFMC).

E. Galvanized steel electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. High-density polyethylene (HDPE) conduit.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.

B. Section 260526-Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 260529-Hangers and Supports for Electrical Systems.

D. Section 260533.16-Boxes for Electrical Systems.

E. Section 260553-Identification for Electrical Systems: Identification products and requirements.

F. Section 262100-Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal); 2010 (Reapproved 2019).

E. ASTM D1598 - Standard Test Methods for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure; 2021.

F. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.

G. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

H. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing; 2016.

I. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing; 2016a.

J. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD); 2016.

K. ASTM F2176 - Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct; 2017.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

M. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

N. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

O. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

P. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

Q. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

R. NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit; 2021.

S. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

U. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

V. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

W. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

X. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

Y. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Z. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

AA. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

BB. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

CC. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Dewberry Engineers, Inc. of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded in concrete slabs, and all feeder conduits.

1.06 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions, shop drawings, and reference standard documents containing execution requirements as applicable.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit unless otherwise indicated.
   2. Exterior, Direct Buried: Use rigid PVC conduit unless otherwise indicated.
   3. Embedded Within Concrete: Use rigid PVC conduit unless otherwise indicated.
   4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) with two coats of epoxy asphaltum paint where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) for bends of 45 degrees or greater.
   6. Where galvanized rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC), emerges from concrete into soil, use 2 coats of asphaltum paint to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC). Embed within structural slabs only where approved by Structural Engineer.
   2. Within Slab Above Ground: Use rigid PVC conduit where approved by Structural Engineer unless noted otherwise.
   3. Within Concrete Walls Above Ground: Use rigid PVC conduit unless noted otherwise.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) with 2 coats of asphaltum paint. where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), or intermediate metal conduit (IMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet (6.1 m) in warehouse areas.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact with Earth: Use galvanized steel rigid metal conduit (RMC), intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).

L. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet (1.8 m).

M. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Motors.

N. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
   1. Where permitted, existing conduits to be reused may be used as sole equipment grounding conductor only when continuity of conduit pathway, including associated boxes and fittings, is verified; see Section 260526.

C. Electrical Service Conduits: See Section 262100 for additional requirements.

D. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.

E. Provide conduit, fittings, supports, and accessories required for complete raceway system.

F. Provide products listed, classified, and labeled as suitable for purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4-inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
   3. Control Circuits: 1/2-inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.
   5. Underground, Interior: 3/4-inch (21 mm) trade size.
   6. Underground, Exterior: 1-inch (27 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube Company.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

c. Bridgeport Fittings Inc.
d. O-Z/Gedney, a brand of Emerson Industrial Automation.

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit.
2. Republic Conduit.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube Company.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
   c. Bridgeport Fittings Inc.
   d. O-Z/Gedney, a brand of Emerson Industrial Automation.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
3. Material: Use steel.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Electri-Flex Company.
3. International Metal Hose.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1 and listed for use in classified firestop systems.

C. Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Bridgeport Fittings Inc.
   c. O-Z/Gedney, a brand of Emerson Industrial Automation.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
   a. Do not use die cast zinc fittings.

2.06 LIQUID TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc.

2. Electri-Flex Company.
3. International Metal Hose.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Bridgeport Fittings Inc.
c. O-Z/Gedney, a brand of Emerson Industrial Automation.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit.
2. Republic Conduit.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube Company.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
c. Bridgeport Fittings Inc.
d. O-Z/Gedney, a brand of Emerson Industrial Automation.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use set-screw type.
a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. ABB; Carlon: www.carlon.com/#sle.
2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
3. Cantex Inc.
4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
5. JM Eagle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651 Schedule 409 unless otherwise indicated rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 HIGH-DENSITY POLYETHYLENE (HDPE) CONDUIT

A. Manufacturers:
   1. ABB; Carlon: www.electrification.us.abb.com/#sle.
   2. Blue Diamond Industries, LLC: www.bdiky.com/#sle.
   3. Eastern Wire + Conduit, a division of Atkore International: www.easternwire.com/#sle.

B. Description: NFPA 70, Type HDPE high-density polyethylene solid-wall conduit complying with ASTM F2160 and NEMA TC 7; list and label as complying with UL 651A; Schedule 40 unless otherwise indicated .

C. Joining Methods: Approved by HDPE conduit manufacturer.

D. Mechanical Fittings: Comply with ASTM F2176; list and label as complying with UL 651A.

E. Butt Heat Fusion Fittings: Comply with ASTM D3261.

F. Socket Fusion Fittings: Comply with ASTM D2683.

G. Electrofusion Fittings: Comply with ASTM F1055.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Adhesive for HDPE Conduit:
   1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
   2. Approved by adhesive manufacturer for use with materials to be joined.
   3. Adhesive Shear Strength: Not less than 100 psi (720 kPa), when tested in accordance with ASTM D1002.
   4. Hydrostatic Pressure Resistance: No leaks, when tested in accordance with ASTM D1598 at 120 psi (830 kPa) for 1,000 hours and when tested in accordance with ASTM D1599 at 250 psi (1700 kPa).

E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kn).

F. Foam Conduit Sealant:
   1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Rated to hold minimum of 10 ft (3.0 m) water head pressure.
   4. Products:
      a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
      b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.

G. Conduit Mechanical Seals:
   1. Listed as complying with UL 514B.
   2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   3. Suitable for sealing around conductors/cables to be installed.

4. Products:
    a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.

H. Sealing Systems for Concrete Penetrations:
1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
3. Products:
    a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
    b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
    c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
    d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

I. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
1. Products:
    a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
    b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
1. Products:
    a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
1. Products:
    a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
1. Products:
    a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   13. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   14. Group parallel conduits in same area on common rack.

G. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods; see Section 260529.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
   7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
   8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
   9. Use of spring steel conduit clips for support of conduits is permitted only as follows:
      a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.

10. Use of wire for support of conduits is not permitted.
11. Spring steel fasteners are not permitted for use in vertical runs. Support individual vertical runs using two holder straps. Support parallel runs of vertical raceway together on channel using bolted clamps.
12. Where conduit support intervals specified in NFPA 70 differ, comply with most stringent requirements.
13. Support raceways installed on interior of exterior building walls a minimum of 1/4-inch from wall surface using "clamp-back" struts.
14. Spring steel fasteners are not permitted for use in vertical runs. Support individual vertical runs using two-hole straps. Support parallel runs of vertical raceway together on channel using bolted clamps.

H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquid tight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements.

J. Underground Installation:
1. Provide trenching and backfilling.
2. Minimum Cover, Unless Otherwise Indicated or Required:
    a. Underground, Exterior: 24 inches (610 mm).
    b. Under Slab on Grade: 4 inches (100 mm) to bottom of slab.
3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 260553.

K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 3/4-inch (21 mm) trade size unless otherwise approved.

2. Minimum Conduit Spacing: As approved by Structural Engineer.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 033000.

M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

N. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
a. Where conduits enter building from outside.
b. Where service conduits enter building from underground distribution system.
c. Where conduits enter building from underground.
d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
a. Where conduits pass from outdoors into conditioned interior spaces.
b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
c. Where conduits penetrate coolers or freezers.
3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals locate as indicated or in accordance with NFPA 70.

O. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

P. Provide grounding and bonding; see Section 260526.

Q. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

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SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 260526-Grounding and Bonding for Electrical Systems.

B. Section 260529-Hangers and Supports for Electrical Systems.

C. Section 260533.13-Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 260553-Identification for Electrical Systems: Identification products and requirements.

E. Section 262726-Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   4. Additional requirements for locating boxes for wiring devices.

F. Section 262813-Fuses: Spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Project Record Documents: Record actual locations for outlet and device boxes, junction boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes in concealed or unfinished dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where conduit is routed exposed in finished spaces.
4. Use raised covers suitable for the type of wall construction and device configuration where required.
5. Use shallow boxes where required by the type of wall construction.
6. Do not use "through-wall" boxes designed for access from both sides of wall.
7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
11. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4-inch square by 2-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 2-1/8 inch deep (100 by 54 mm) trade size.
12. Wall Plates: Comply with Section 262726.
13. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation
    b. Hubbell Incorporated; Bell Products
    c. Hubbell Incorporated; RACO Products
    d. O-Z/Gedney, a brand of Emerson Industrial Automation
    e. Thomas & Betts Corporation

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel, Type 1, galvanized steel, or Type 12, painted steel.
    b. Outdoor Locations: Type 3R, painted steel, Type 4, painted steel, Type 4X, stainless steel, or Type 4X, fiberglass.
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm) :
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable, stainless steel, removable, or painted 3/4-inch fire-retardant plywood.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation
    b. Hoffman, a brand of Pentair Technical Products

c. Hubbell Incorporated; Wiegmann Products

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
   1. Manufacturers:
      a. Hubbell Incorporated: www.hubbell.com/#sle.

E. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
   2. Use cast-iron or nonmetallic floor boxes within slab on grade.
   3. Use sheet-steel, cast iron, or nonmetallic floor boxes within slab above grade.
   4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour.
   5. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom or solid bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless-steel tamper resistant cover bolts.
   2. Size: As indicated on drawings.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
   4. Provide logo on cover to indicate type of service.
   5. Applications:
      a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating or polymer concrete enclosures, with minimum SCTE 77 Tier 5 load rating.
      b. Parking Lots, in Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating or polymer concrete enclosures, with minimum SCTE 77 Tier 22 load rating.
      c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
   6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Manufacturers:
         1) Hubbell Incorporated; Quazite Products
         2) MacLean Highline
         3) Oldcastle Precast, Inc
      b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130 including mounting heights specified in those standards where mounting heights are not indicated except for mounting heights specified in those standards.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels as required.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
      b. Communications Systems Outlets.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

K. Floor-Mounted Cabinets: Mount on properly sized 4 inch (100 mm) high concrete pad.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch (25 mm) above finished grade.
4. Provide cast-in-place concrete collar constructed, minimum 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep), around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 262726-Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2021.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate or identification labels to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Switchboards:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Use identification nameplate or identification label to identify main overcurrent protective device.
        5) Use identification nameplate or identification label to identify load(s) served for each branch device. Identify spares and spaces.
    b. Panelboards:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Identify main overcurrent protective device. Use identification nameplate or identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate or identification label.
        5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
        6) For power panelboards without a door, use identification nameplate or identification label to identify load(s) served for each branch device.
    c. Enclosed switches, circuit breakers, and motor controllers:
        1) Identify voltage and phase.
        2) Identify power source and circuit number. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location when not within sight of equipment.
    d. Enclosed Contactors:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
        4) Identify coil voltage.
        5) Identify load(s) and associated circuits controlled. Include location.
    e. Centralized Emergency Lighting Inverters:
        1) Identify input and output voltage and phase.
        2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location.
    f. Electricity Meters:
        1) Identify load(s) metered.
2. Service Equipment:
    a. Use identification nameplate or identification label to identify each service disconnecting means.

b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Use identification label to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate or identification label to identify disconnect location for equipment with remote disconnecting means.
5. Use identification nameplate or identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use identification nameplate or identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT". Color red.
7. Use field-painted floor markings or floor marking tape to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Specifications.
8. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
   b. Elevator control panels.
   c. Panelboards.
9. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
   b. Legend: Include red header that reads "DANGER", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements".
   c. Service Equipment: Include the following information in accordance with NFPA 70.
      1) Nominal system voltage.
      2) Available fault current.
      3) Clearing time of service overcurrent protective device(s).
      4) Date label applied.
10. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only".
11. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
12. Use warning labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing".

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
   2. Identification for Communications Conductors and Cables: Comply with Section 271000.
   3. Use identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.
    c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits 2 inch (53 mm) trade size and largerat maximum intervals of 20 feet (6.1 m).
2. Use color-coded bands or voltage markers to identify systems other than normal power system specified systems for accessible conduits at maximum intervals of 20 feet (6.1 m).
    a. Maximum Intervals: 20 feet (6.1 m).
    b. Color-Coded Bands: Use vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
3. Color code all conduit with vinyl plastic electrical tape, 3M Company “Scotch 35", applied two (2) full turns around conduit, 6" from all conduit terminations into switchboards, panelboards, motor control centers, starters, cabinets, control panels, pull boxes, outlet boxes, etc., on each side of walls, floors or roof penetrated by conduit and where conduit enters wall to outlets below.
    a. Where authority does not allow tape use paint acceptable to authority.
    b. Field-Painting: Comply with Specifications.
    c. Vinyl Color Coding Electrical Tape: Comply with Section 260519.
    d. Color Code:
        1) Fire Alarm System: Red.
4. Use identification labels to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet (6.1 m).

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify specified systems.
    a. Color-Coded Boxes: Field-painted in accordance with Specifications.
        1) Fire Alarm System: Red.
    b. For exposed boxes in public areas, do not color code.
3. Use identification labels to identify circuits enclosed.
    a. For exposed boxes in public areas, provide identification on inside face of cover.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Specification.
2. Wiring Device and Wall plate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wall plates: Comply with Section 272726.
4. Use identification label to identify fire alarm system devices.
    a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use engraved wall plate to identify serving branch circuit for all receptacles.

a. For receptacles in public areas, in public areas, provide identification on inside surface of wall plate provide identification on inside surface of wall plate.

6. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:
   a. Brimar Industries, Inc
   b. Kolbi Pipe Marker Co
   c. Seton Identification Products
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch (3 mm) when any dimension is greater than 4 inches (100 mm).
4. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:
   a. Brady Corporation
   b. Brother International Corporation
   c. Panduit Corp
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm) 2.5 inches (64 mm) unless Drawing details indicate otherwise.
2. Legend:
   a. System designation where applicable:
      1) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch (25 mm).
   b. Equipment Designation: 1/2 inch (13 mm).
   c. Other Information: 1/4 inch (6 mm).
   d. Exception: Provide minimum text height of 1 inch (25 mm) for equipment located more than 10 feet (3.0 m) above floor or working platform.
5. Color:

a. Normal Power System:Black text on white background.
b. Fire Alarm System: White text on red background.
c. _____: _____ text on _____ background.
d. D.C. service System: Blue text on Yellow background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch (6 mm).
5. Color: Black text on white background unless otherwise indicated.

E. Format for Receptacle Identification:
1. Minimum Size: 1/2 inch (13 mm) by 1.5 inches (38 mm).
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch (6 mm).
5. Color: Black text on clear background.

F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Load controlled, or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation
2. HellermannTyton
3. Panduit Corp

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl self-laminating type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed and/or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch (3 mm).

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation

2. Brimar Industries, Inc
3. Seton Identification Products

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc
3. Seton Identification Products

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches (76 mm) wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc
2. Clarion Safety Systems, LLC
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic signs.

b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed and/or machine-printed self-adhesive vinyl or self-adhesive polyester labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
   b. Provide polyester overlaminate to protect handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also, enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Interior Components: Legible from the point of access.
6. Conduits: Legible from the floor.
7. Boxes: Outside face of cover.
8. Conductors and Cables: Legible from the point of access.
9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

SECTION 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13-Conduit for Electrical Systems .

C. Section 260533.16-Boxes for Electrical Systems.

D. Section 262726-Wiring Devices.

E. Section 262816.16-Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type as shown on Drawings, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 261816.16.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

2.02 EQUIPMENT CONNECTIONS

A. Electrical Connection: Flexible conduit.
   1. Electrical Connection: Cord and plug (NEMA 6-20R).

B. Provide field-installed disconnect switch.

C. Voltage: as indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 260583

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. Outdoor photo controls.

D. Lighting contactors.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fand speed controllers.
   1. Includes finish requirements for wall controls specified in this section.
   2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

F. Section 262813 - Fuses.

G. Section 266100 - Interior Lighting.

H. Section 265600-Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

J. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

N. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

O. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide five year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Lutron Electronics Company, Inc
   3. Sensor Switch Inc
   4. WattStopper
   5. Substitutions: See Section 016000 - Product Requirements.
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.

3. Provide LED to visually indicate motion detection.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
13. Load Rating for Line Voltage Occupancy Sensors:
    a. Incandescent Load: Not less than 800 W.
    b. Fluorescent Load: Not less than 800 W at 120 V ac and 1,200 W at 277 V ac.
    c. Motor Load: Not less than 1/6 HP.
14. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
15. Where wired sensors are indicated, wireless sensors are not acceptable without prior approval of Architect.

C. Wall Switch Occupancy Sensors:
    1. All Wall Switch Occupancy Sensors:
        a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
        b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
        c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
        d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
        e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
        f. Provide selectable audible alert to notify occupant of impending load turn-off.
        g. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
        h. Provide vandal resistant lenses for wall switch occupancy sensors where indicated.
    2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).

D. Ceiling Mounted Occupancy Sensors:
    1. All Ceiling Mounted Occupancy Sensors:
        a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

F. Accessories:
1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

2.03 OUTDOOR MOTION SENSORS

2.04 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc
2. Tork, a division of NSI Industries LLC
3. Substitutions: See Section 016000 - Product Requirements.
4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. 7-Day Time Switches: Four channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
b. Astronomic Time Switches: Four channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input with light level adjustment.
8. Input Supply Voltage: As indicated on the drawings.
9. Output Switch Configuration: As required to control the load indicated on drawings.
10. Provide lockable enclosure; environmental type per NEMA 250
a. Indoor clean, dry locations: Type 1.

b. Outdoor locations: Type 3R.

11. Provide flush-mounted unit where indicated.

C. Electromechanical Time Switches:

1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
2. Program Capability:
   a. 7-Day Time Switches: Capable of different schedule for each day of the week.
   b. Astronomic Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
3. Schedule Capacity:
   a. 7-Day Time Switches: Accommodating not less than two pairs of selected on/off operations per day.
   b. Astronomic Time Switches: Capable of turning load on at sunset and off at either sunrise or selected fixed time.
4. Provide spring reserve backup to maintain clock during power outage.
5. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
6. Input Supply Voltage: As indicated on the drawings.
7. Output Switch Configuration: As required to control the load indicated on drawings.
8. Provide lockable enclosure; environmental type per NEMA 250
   a. Indoor clean, dry locations: Type 1.
   b. Outdoor locations: Type 3R.
9. Provide flush-mounted unit where indicated.

2.05 IN-WALL TIME SWITCHES

2.06 IN-WALL INTERVAL TIMERS

2.07 OUTDOOR PHOTO CONTROLS

A. Manufacturers:

1. Intermatic, Inc
2. Tork, a division of NSI Industries LLC
3. Substitutions: See Section 016000 - Product Requirements.
4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls

1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.

2. Housing: Weatherproof, impact resistant UV stabilized polypropylene.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.
9. Provide the following accessories where indicated or as required to complete installation:
    a. Receptacle: Complying with ANSI C136.10.
    b. Mounting Bracket.
    c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.

D. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

2.08 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB/GE: www.electrification.us.abb.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. General Electric Company: www.geindustrial.com/#sle.
4. Rockwell Automation Inc; Allen-Bradley Products; ab.rockwellautomation.com/#sle.
5. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
6. Siemens Industry, Inc; : www.usa.siemens.com/#sle.
7. Substitutions: See Section 016000 - Product Requirements.

B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect.
1. Disconnects: Circuit breaker type.
    a. Disconnect Switches: Fusible type unless otherwise indicated.
    b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

D. Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

E. Enclosures:
1. Comply with NEMA ICS 6.

2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.

2.09 ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
2. Nominal Size: 30 mm.
3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
5. Indicating Lights: Push-to-test type unless otherwise indicated.
6. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
2. Provide number and type of relays indicated or required to perform necessary functions.
3. Timing Relays: Electronic.
   a. Adjustable Timing Range: As indicated on drawings.

D. Fire-Rated Device Enclosures:
1. Manufacturers:
   a. Fire Rated Product Specialties Corp: www.frpsonline.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.
2. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control relays furnished under Section 253626

C. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: As indicated on the drawings.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Dewberry Engineers, Inc. to obtain direction prior to proceeding with work.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

H. Provide required supports in accordance with Section 260529.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Identify lighting control devices in accordance with Section 260553.

K. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Dewberry Engineers, Inc..
   2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   3. Install power pack and Class 2 low voltage conductors in suitable box/raceway: Connections between power pack low voltage conductros and low voltage conductors to control devices shall not be exposed.
   4. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

N. Combination Enclosed Lighting Contactors:
   1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
   2. Provide fuses complying with Section 262813262813.01 for fusible switches as indicated.

O. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

P. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling near the sensor location.

Q. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

R. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

S. Where indicated or required, provide cabinet or enclosure in accordance with Section 260533.01 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Dewberry Engineers, Inc.

C. Adjust position of directional occupancy sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Dewberry Engineers, Inc.. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Dewberry Engineers, Inc.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Dewberry Engineers, Inc., and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized service representative.
   4. Location: At project site.

END OF SECTION 260923

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SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526-Grounding and Bonding for Electrical Systems.

C. Section 260529-Hangers and Supports for Electrical Systems.

D. Section 260533.13-Conduit for Electrical Systems.

E. Section 260553-Identification for Electrical Systems: Identification products and requirements.

F. Section 262416-Panelboards: Service entrance equipment.

G. Section 262816.16-Enclosed Switches: Service entrance equipment.

H. Section 264300-Surge Protective Devices: Service entrance surge protective devices.

I. Section 312316 - Excavation.

J. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

K. Section 312323 - Fill: Bedding and backfilling.

L. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances:
   1. See Section 012100 - Allowances, for allowances affecting this section.
   2. Include cash allowance for Utility Company charges associated with providing service.

B. Unit Prices:
   1. See Section 012200 - Unit Prices, for additional unit price requirements.
   2. Primary:
      a. Basis of Measurement: By the lineal foot (meter), for each configuration.
      b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
   3. Secondary:
      a. Basis of Measurement: By the lineal foot (meter), for each configuration.
      b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
   4. Transformer Pad/Vault:
      a. Basis of Measurement: Per unit, for each type.
      b. Basis of Payment: Includes purchase, delivery, and installation.

1.04 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.05 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.06 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. The Contractor shall pay the power and communication utilities fees, assessments, charges, etc. required by that utility to provide service to the facility. If an allowance for these costs is indicated within Specifications or on the Drawings these costs shall be drawn from this allowance with all remaining monies returned to the Owner. Include all costs on the Schedule of Values. See Paragraph 1.03.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
   2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Utility Company letter of availability for providing electrical service to project. Letter to include transformer kVA rating, impedance and available short circuit current at the service point.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
   1. Obtain Utility company approval of shop drawings prior to submittal.

E. Drawings prepared by Utility Company.

F. Project Record Documents: Record actual locations of equipment and installed service routing.

1.08 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.
   4. The requirements of the local authorities having jurisdiction.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new or modify the existing electrical service as indicated on the drawings consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults: Furnished and installed by Contractor per Utility Company requirements.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
      d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
      e. Primary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Utility Company.
      f. Secondary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Contractor.
   2. Pole-Mounted Utility Transformers:
      a. Utility Poles: Furnished and installed by Utility Company.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
      d. Primary: Furnished and installed by Utility Company.
      e. Secondary - Underground Service:

1) Conduits and pull boxes furnished and installed by Contractor.
2) Conductors: Furnished and installed by Contractor.

f. Secondary - Overhead Service:
1) Conduits/Service Masts: Furnished and installed by Contractor.
2) Conductors: Furnished and installed by Contractor (Service Point at service mast).

3. Terminations at Service Point: Provided by Utility Company.
4. Metering Provisions:
a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
d. Metering Transformers: Furnished and installed by Utility Company.
e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Section 312316.13 as described in Section 260500.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03300 or as described in Section 260500.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 260529.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 262100

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 260526-Grounding and Bonding for Electrical Systems.

B. Section 260529-Hangers and Supports for Electrical Systems.

C. Section 260553-Identification for Electrical Systems: Identification products and requirements.

D. Section 262813-Fuses: Fuses for fusible switches and spare fuse cabinets.

E. Section 264300-Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as design and routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.
   3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
   2. Panelboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.electrification.us.abb.com/#sle.

B. Eaton Corporation

C. Schneider Electric; Square D Products

D. Siemens Industry, Inc

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
      b. Panelboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   3. Listed series ratings are not acceptable.

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   3. Provide separate isolated/insulated ground bus where indicated and/or where isolated grounding conductors are provided.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations.
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide removable end walls for NEMA Type 1 enclosures.
      d. Provide painted steel boxes for surface-mounted panelboards where exposed to publc views, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

O. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs and feeders as indicated or as required to interconnect sections.

P. Load centers are not acceptable unless specifically indicated on the Drawings.

Q. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type.
   2. Provide circuit breakers as required to achieve selective coordination as specified or indicated in coordination study.
   3. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than (400) amperes and electronic trip circuit breakers for circuit breaker frame sizes (400) amperes and above.

E. Enclosures:
   1. Provide surface-mounted and/ or flush mounted enclosures as indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   5. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated or required to achieve level of selective coordination.

E. Enclosures:
1. Provide surface-mounted and/ or flush mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
4. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
a. Provide the following field-adjustable trip response settings:
1) Long time pickup, adjustable by setting dial.
2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.
b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
c. Provide communication capability where indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install panelboards plumb.

H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

I. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

J. Mount floor-mounted power distribution panelboards on properly sized 4 inch (100mm) high concrete pad constructed in accordance with Section 033000.

K. Provide minimum of six spare 1 inch (27mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

L. Provide grounding and bonding in accordance with Section 260526.
    1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
    2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

M. Install all field-installed branch devices, components, and accessories.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

S. Provide bussing and bus fingers, hardware, accessories, etc. where breaker spaces are indicated.

Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than (400) amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

E. Test GFCI circuit breakers to verify proper operation.

F. Test AFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

F. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

A. Section 260519-Low Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 260526-Grounding and Bonding for Electrical Systems.

C. Section 260533.13-Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260583 - Wiring Connections: Cords and plugs for equipment.

F. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g, with Amendment.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
1. Wall Dimmers: Include derating information for ganged multiple devices.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:
1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Wall Plates: One of each style, size, and finish.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated

B. Leviton Manufacturing Company, Inc

C. Lutron Electronics Company, Inc

D. Pass & Seymour, a brand of Legrand North America, Inc

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed where children might be present.

E. Provide GFCI circuit breakers or remote GFCI modules for personnel protection for circuits feeding receptacles that are not readily accessible and require GFCI protection.

F. Provide GFCI protection for receptacles serving equipment and appliances in locations as required by the current edition of the National Electrical Code.

G. Devices indicated as GFCI receptacles on the Drawings shall be of the GFCI type. Do not rely on upstream protection or "feed-thru protection" by another device unless specifically indicated otherwise.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

I. For flush floor service fittings, use tile rings for installations in tile floors.

J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 WIRING DEVICE FINISHES

A. Renovation projects shall be provided with devices that match the finish of existing devices in that space, unless noted otherwise.

B. Provide wiring device finishes as described below unless otherwise indicated.

C. Wiring Devices Installed in Unfinished Spaces: Use galvanized steel wall plates.

D. Wiring Devices Installed in Wet or Damp Locations: Use with specified weatherproof cover.

E. Flush Floor Box Service Fittings: Receptacle color specified above with brass cover and ring/flange.

F. Flush Poke-Through Service Fittings: Receptacle color specified above with brass cover and flange.

2.04 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Hubbell Incorporated
   3. Leviton Manufacturing Company, Inc
   4. Pass & Seymour, a brand of Legrand North America, Inc:
   5. Wiremold
   6. Walker

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc
   2. Lutron Electronics Company, Inc:
   3. Pass & Seymour, a brand of Legrand North America, Inc
   4. Submit list of devices (with catalog numbers) proposed for review pior to ordering.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Rotary control type with rotary on/off control.

D. Power Rating as required for the connected load.

E. Provide locator light, illuminated with load off.

F. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.06 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
   3. Tamper Resistant Convenience Receptacles: Industrial specification grade Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, Class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Industrial specification grade Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.

5. Tamper Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
6. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.07 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.
4. Provide screwless wall plates with concealed mounting hardware where indicated.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.08 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Rectangular.
b. Configuration: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
2. Single Service Flush Communications Outlets:
a. Cover: Rectangular.
b. Voice and Data Jacks as specified.
3. Single Service Flush Furniture Feed:
a. Cover: Rectangular.
b. Configuration: One 2-1/8 inch by 3/4-inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
a. Cover: Rectangular.
b. Configuration:
1) Power: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
2) Voice and Data Jacks as specified.
5. Dual Service Flush Furniture Feed:

a. Cover: Rectangular.
b. Configuration:
1) Power: One 2-1/8 inch by 3/4-inch combination threaded opening(s).
2) Communications: One One 2-1/8 inch by 1 inch combination threaded opening(s).

6. Accessories:
a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.09 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Configuration: One standard convenience duplex receptacle(s) with hinged door opening(s).
2. Single Service Flush Communications Outlets:
a. Voice and Data Jacks: As specified.
3. Single Service Flush Furniture Feed:
a. Configuration: One 2-inch by 1-1/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
a. Cover: Hinged door(s).
b. Configuration:
1) Power: One standard convenience, standard convenience duplex receptacle.
2) Voice and Data Jacks: As specified.
5. Dual Service Flush Furniture Feed:
a. Configuration:
1) Power: One 3/4 inch threaded opening(s).
2) Communications: Two 1/2 inch threaded opening(s).
6. Accessories:
a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

2.10 WIRING DEVICES - BASIS OF DESIGN

DEVICE	NEMA CONF. & RATING	MANUFACTURER	CATALOG # HEAVY DUTY SPEC GRADE	CATALOG # HOSPITAL GRADE
Single Receptacle	5-20R	Hubbell	HBL5361	HBL8310
Single Receptacle	6-20R	Hubbell	HBL5461	HBL5461
Single Receptacle	14-20R	Hubbell	HBL8410	HBL8410
Single Receptacle	15-20R	Hubbell	HBL8420	HBL8420
Single Receptacle	5-30R	Hubbell	HBL9308	HBL9308
Single Receptacle	6-30R	Hubbell	HBL9330	HBL9330
Single Receptacle	14-30R	Hubbell	HBL9430A with 6ft. rubber cord set	HBL9430A with 6ft. rubber cord set
Single Receptacle	6-50R	Hubbell	HBL9367 w/9368 plug	HBL9367 w/9368 plug
Single Receptacle	14-50R	Hubbell	HBL9450A w/ cord set	HBL9450A w/ cord set
Single Receptacle	15-50R	Hubbell	HBL8450A w/ cord set	HBL8450A w/ cord set
Single Receptacle	L5-20R	Hubbell	HBL2310	HBL2310
Single Receptacle, Portable X-ray	X-Ray 60A, 250V (2P,3W)	Hubbell	N/A	HBL25605 w/ 25615 plug
Duplex Receptacle	5-20R	Hubbell	HBL5362	HBL8300H
Duplex Receptacle, Isolated Ground	5-20R IG	Hubbell	IG5362	IG8362SA
Duplex Receptacle, GFCI, Weatherproof	5-20R GF	Hubbell	GFR5362TR w/ WP26E cover	GFR8300TR w/ WP26E cover
Duplex Receptacle, Tamper-Proof	5-20R TP	Hubbell	HBL8300SG	HBL8300SG
Duplex Receptacle, GFCI	5-20R GF	Hubbell	GFR5362TR	GFR8300HLA
Floor Outlet with Equipment Connection	¾" NPT	Wiremold	881/881ADP-896	881/881ADP-896
Floor Outlet with Duplex Receptacle	5-20R	Wiremold	881/881ADP-895/ HBL5362	881/881ADP-895/ HBL8300H
Floor Outlet Double Duplex Receptacle	5-20R	Wiremold	880MP-827-(2)828R/ HBL5362	880MP-827-(2)828R/ HBL8300H
Wall Switch 1-Pole	20A,120/277 V	Hubbell	CS1221	CS1221
Wall Switch 2-Pole	20A,120/277 V	Hubbell	CS1222	CS1222
Wall Switch 3-Way	20A,120/277 V	Hubbell	CS1223	CS1223
Wall Switch 4-Way	20A,120/277 V	Hubbell	CS1224	CS1224
Wall Switch, SPDT Momentary Contact, Center OFF	20A,120/277 V	Hubbell	HBL1557	HBL1557
Wall Switch 1-Pole, Locking Key	20A,120/277 V	Hubbell	HBL1221L	HBL1221L
Wall Switch 1-Pole, Pilot	20A,120/277 V	Hubbell	HBL1221PL	HBL1221PL
Wall Switch 1-Pole Lighted Handle	20A,120/277 V	Hubbell	HBL1221ILC	HBL1221ILC

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that core drilled holes for poke-through assemblies are in proper locations.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights (to center of device) :Unless otherwise indicated, as follows:
   a. Wall Switches: 48 inches (1200 mm) above finished floor.
   b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
   c. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Dewberry Engineers, Inc. to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Identify wiring devices in accordance with Section 260553.

R. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Dewberry Engineers, Inc.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

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SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

A. Section 260553-Identification for Electrical Systems: Identification products and requirements.

B. Section 262416-Panelboards: Fusible switches.

C. Section 262816.16-Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Panelboards: See Section 262416.
      b. Fusible Enclosed Switches: See Section 262816.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000-Product Requirements for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation.

B. Littelfuse, Inc.

C. Mersen.

D. Ferraz Shawmut, Inc.

E. Substitutions: See Section 016000-Product Requirements.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

I. Class CC Fuses: Comply with UL 248-4.

J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

K. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.04 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION 262813

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SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526-Grounding and Bonding for Electrical Systems.

B. Section 260529-Hangers and Supports for Electrical Systems.

C. Section 260553-Identification for Electrical Systems: Identification products and requirements.

D. Section 262813-Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual locations of enclosed switches.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000-Product Requirements, for additional provisions.
   2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Substitutions: See Section 016000-Product Requirements.

F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings. Where no available fault current is indicated at the enclosed switch location, use the available fault current shown at the immediately upstream distribution board.

H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

I. Provide with switch blade contact position that is visible when the cover is open.

J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

K. Conductor Terminations: Suitable for use with the conductors to be installed.

L. Provide insulated, groundable fully rated solid neutral assembly, with a suitable lug for terminating each neutral conductor.

M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

N. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

P. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

Q. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.

3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Provide required seismic controls in accordance with Section 260548.

F. Install enclosed switches plumb.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 260525.

I. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

A. Section 134613 - Lightning Protection for Structures.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 262416 - Panelboards.

D. Section 262726 - Wiring Devices: Receptacles with integral surge protection.

E. Section 271000 - Structured Cabling: Protectors for communications service entrance.

F. Section 284600 - Fire Detection and Alarm.

1.03 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2019).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
   1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
2. UL 1283 (for Type 2 SPDs).

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:
1. ABB/GE: www.electrification.us.abb.com/#sle.
2. Current Technology; a brand of Thomas & Betts Power Solutions.
3. nVent ERICO: www.nvent.com/#sle.
4. Schneider Electric; Square D Brand Surgelogic Products.
5. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:
1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

C. Substitutions: See Section 016000 - Product Requirements.

D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.
   2. Single Split Phase Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. Equivalent to basis of design.
   2. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted adjacent to surface-mounted equipment.
   2. Provide flush-mounted SPD where mounted adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Panelboards: See Section 262416.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular.
   2. Surge Current Rating: Not less than 240 kA per mode/480 kA per phase.
   3. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
   4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.
      a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
   7. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
      c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six-digit LCD display that indicates quantity of surge events.

8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

B. Surge Protective Device:
1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 160 kA per mode/320 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 3,500 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.
   a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six-digit LCD display that indicates quantity of surge events.
8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:
1. Protection Circuits: Field-replaceable modular.
2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.
   a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six-digit LCD display that indicates quantity of surge events.

8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.06 POWERLINE CORD/DIRECT-WIRED (120 VAC) SUPPRESSORS:

A. Suppressors shall consist of a three-stage hybrid design. First stage M.O.V., second stage air-core 300 uh inductor, and third stage silicon avalanche diode.

B. The suppressor shall provide certified test data confirming a fail short failure mode

C. Suppressor shall provide three suppression modes. Line to neutral, line to ground, and neutral to ground.

D. Suppressor shall provide a maximum single impulse current rating of 10,000 amperes (8 x 20 us - waveform) per mode.

E. Suppressor shall provide a pulse life rating of 3,000 amperes (8 x 20 us - waveform) every thirty (30) seconds for 2,000 occurrences.

F. Suppressors maximum clamping voltage when subjected to the ANSI/IEEE C62.41 - 1980, Cat. B (6kv-1.2 x 50 us, 3kA impulse) shall not exceed 450 Volts peak.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 ELECTRONIC POWER SUPPLY:

A. Install one each powerline cord or direct-wired branch circuit suppressor between each equipment item and its power supply conductors as follows:
   1. Fire Alarm Master Panel
   2. Building Management System headend
   3. Security System headend
   4. Telephone switch

B. Install suppressor according to manufacturer's recommendations

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Provide and install surge protection devices to meet the requirements of Section 134613 Lightning Protection for Structures.

3.05 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 264300

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 260529-Hangers and Supports for Electrical Systems.

B. Section 260533.16-Boxes for Electrical Systems.

C. Section 260553-Identification for Electrical Systems: Identification products and requirements.

D. Section 260923-Lighting Control Devices.
   1. Includes automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
   2. Includes lighting contactors.

E. Section 262726-Wiring Devices: Manual wall switches and wall dimmers.

F. Section 265600-Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C82.4 - American National Standard for Lamp Ballasts - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps; 2017.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts; 2017.

D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).

E. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

F. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

G. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

H. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

I. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

K. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

L. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

M. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

N. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

R. UL 1598 - Luminaires; Current Edition, Including All Revisions.

S. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

T. UL 1993 - Self-Ballasted Lamps and Lamp Adapters; Current Edition, Including All Revisions.

U. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
   3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Field quality control reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting).

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year warranty for batteries for emergency lighting units.

D. Provide 5-year warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS - LUMINAIRES

A. Refer to Luminaire Schedule and Drawings.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000-Product Requirement.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Sealed maintenance-free lead calcium unless otherwise indicated.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101; provide indicator light(s) to report test and diagnostic status.

G. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.

H. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes and listed and labeled as complying with UL 924.
1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
1. Self-Powered Exit Signs:
a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low voltage disconnect to prevent battery damage from deep discharge.
e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101; provide indicator light(s) to report test and diagnostic status.

C. Accessories:
1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
4. LED Drivers: Provide drivers that provide LED lumen output using standard driver current for Luminaire as scheduled driver current to achieve specified lumen output is not acceptable.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to 1% or 10%, as indicated in the Luminaire Schedule, percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   a. Wall Dimmers: See Section 262726.

2.06 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com.
   2. Osram Sylvania: www.sylvania.com.
   3. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.
   4. Philips Lighting Company: www.lighting.philips.com.
   5. Substitutions: See Section 016000 - Product Requirements.
   6. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
   7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Dewberry Engineers, Inc. to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260553 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

O. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

P. Remote Ballast drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

Q. Identify luminaires connected to emergency power system in accordance with Section 260554.

R. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Dewberry Engineers, Inc.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Dewberry Engineers, Inc. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Dewberry Engineers, Inc. or authority having jurisdiction.

C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Dewberry Engineers, Inc.

D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Dewberry Engineers, Inc. or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Dewberry Engineers, Inc., and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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SECTION 265600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. LED replacement lamps.

E. LED retrofit luminaire conversion kits.

F. Poles and accessories.

G. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 260526-Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 262726 - Wiring Devices: Receptacles for installation in poles.

F. Section 262813 - Fuses.

G. Section 260650.16 - Lighting Fixture Schedule.

H. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2022).

C. ANSI C82.4 - American National Standard for Lamp Ballasts - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps; 2017.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts; 2017.

E. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.

F. ANSI O5.1 - American National Standard for Wood Poles: Specifications and Dimensions; 2022.

G. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).

H. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

I. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

J. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

K. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

L. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

M. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

N. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2021.

O. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

P. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

Q. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.

R. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

S. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

U. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

V. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

W. UL 1598 - Luminaires; Current Edition, Including All Revisions.

X. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

Y. UL 1993 - Self-Ballasted Lamps and Lamp Adapters; Current Edition, Including All Revisions.

Z. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution.
   3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data in IES LM-63 standard format upon request upon request.
   3. Lamps: Include rated life and initial and mean lumen output.

4. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.
5. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content, showing compliance with specified requirements.

E. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed.

F. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two, two of each type.
5. Touch-Up Paint: 2 gallons (8 liters), to match color of pole finish.

J. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5-year manufacturer warranty for all LED luminaires, including drivers.

C. Provide 5-year manufacturer warranty for LED replacement lamps.

D. Provide 5-year manufacturer warranty for LED retrofit luminaire conversion kits.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

I. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. All LED's shall be sorted and provided to have ANSI McAdam Ellipse standard deviation color matching (SDCM) of 2 or better.

L. Exposed Hardware: Stainless steel.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

C. High Intensity Discharge (HID) Ballasts: Unless otherwise indicated, provide electromagnetic ballasts complying with ANSI C82.4 and listed and labeled as complying with UL 1029.

1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 5 percent.
2. Power Factor: Not less than 0.90 unless otherwise indicated.
3. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of -22 degrees F (-30 degrees C).

2.04 LAMPS

A. Manufacturers:
1. General Electric Company/GE Lighting
2. Osram Sylvania
3. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.
4. Philips Lighting Company
5. Substitutions: See Section 016000 - Product Requirements.
6. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Dewberry Engineers, Inc. to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet (1.2 m) between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts as required to adjust to plumb.
      d. Tighten anchor bolt nuts to manufacturer's recommended torque.
      e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
      f. Install anchor base covers as indicated.
   3. Embedded Poles: Install poles plumb as indicated.
   4. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
      b. Provide supplementary ground rod electrode as specified in Section 260526 at each pole bonded to grounding system as indicated.
   5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
   6. Install non-breakaway in-line fuse holders and fuses complying with Section 262813 in pole handhole or transformer base for each ungrounded conductor.
   7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 262726 in designated poles.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Dewberry Engineers, Inc.

E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Dewberry Engineers, Inc. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Dewberry Engineers, Inc.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Dewberry Engineers, Inc., and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

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SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.

C. Section 087100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

D. Section 142100 - Electric Traction Elevators: Elevator systems monitored and controlled by fire alarm system.

E. Section 142400 - Hydraulic Elevators: Elevator systems monitored and controlled by fire alarm system.

F. Section 211300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

G. Section 233300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

H. Section 260500- Common Work Results for Electrical Systems

I. Section 260519- Low-Voltage Electrical Power Conductors and Cables

J. Section 260526- Grounding and Bonding for Electrical Systems

K. Section 260533.13 Conduit for Electrical Systems

L. Section 260533.16 Boxes for Electrical Systems

M. Section 260553 – Identification for Electrical Systems.

N. Section 275129.13 - Rescue Assistance Signal Systems: Two-way emergency communication systems for areas of refuge/rescue assistance.

O. Section 285001-Emergency Radio Responders System

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities 2020.

G. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 601 - Standard for Security Services in Fire Loss Prevention 2020.

I. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.

J. UL 38 – Standard for Manual Signaling Boxes for Fire Alarm Systems

K. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with Contract Documents.
   4. Proposed maintenance contract.

C. Drawings must be prepared using AutoCAD Release 2010 or Newer.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix like that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Detailed drawing of graphic annunciator(s).
   11. Certification by Contractor that the system design complies with Contract Documents.
   12. Do not show existing components to be removed.

F. Evidence of installer qualifications.

G. Evidence of instructor qualifications; training lesson plan outline.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

J. Operating and Maintenance Data: See Section 017800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
   2. Complete set of specified design documents, as approved by authority having jurisdiction.
   3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   5. List of recommended spare parts, tools, and instruments for testing.
   6. Replacement parts list with current prices, and source of supply.
   7. Detailed troubleshooting guide and large scale input/output matrix.
   8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

K. Project Record Documents: See Section 017800 for additional requirements; have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

L. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
   3. Certificate of Occupancy.
   4. Maintenance contract.
   5. Report on training results.

M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
   3. In addition to the items in quantities indicated in PART 2, furnish the following:
      a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
      b. One copy, on CD-ROM, of all software not resident in read-only-memory.
      c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.05 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Contract maintenance office located within 50 miles (80 km) of project site.
   5. Certified in the State in which the Project is located as fire alarm installer.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
   1. Honeywell Security & Fire Solutions/Notifier.
   2. Siemens Building Technologies, Inc.
   3. Simplex, a Tyco Business.
   4. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:
   1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com/#sle.
   2. Siemens Building Technologies, Inc: www.sbt.siemens.com/#sle.
   3. Simplex, a brand of Johnson Controls: www.simplex-fire.com/#sle.
   4. Provide initiating devices and notification appliances made by the same manufacturer, as the control unit.

C. Substitutions: See Section 016000 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. ADA Standards.
    b. The requirements of the State Fire Marshal.
    c. The requirements of the local authority having jurisdiction.
    d. Applicable local codes.
    e. Contract Documents (drawings and specifications).
    f. NFPA 101.
    g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Initiation: Manual and Automatic.
6. Notification: Provide audible and visual alarm
7. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
8. Hearing Impaired Occupants: Provide visible notification devices in all common public areas. Comply with the requirements of the ADA.
9. Fire Alarm Control Unit: Location indicated on the Drawings.
10. Reporting to Supervising Station: Dedicated leased telephone lines for connection to a monitoring company service via digital alarm communication transmitter (DACT)
11. Two-Way Telephone: Two way fire service communications shall utilize Emergency Radio Responders System as specified in section 285001
12. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
1. Remote Supervising Station: UL-listed central station under contract to facility.
2. Means of Transmission to Remote Supervising Station: Via cellular dialer.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B.
2. Signaling Line Circuits (SLC)Within Single Building: Class B.
3. Notification Appliance Circuits (NAC): Class B.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72 for minimum 24 hours standby condition and 15 minutes of alarm condition.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

C. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

D. Clearly label components that are "Not In Service."

E. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Dry-pipe sprinkler system pressure.
   3. Dry-pipe sprinkler valve room low temperature.
   4. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   3. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 087100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 087100.
   3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 083323.
      a. Addressable Devices:
         1) Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
         2) Addressable devices, which use a binary-coded address setting method, such as a dip-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
         3) Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel signaling line circuits.

4) Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDS Both LEDS shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDS shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the led flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm led.
5) The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6) Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA 72.
7) The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 dba minimum, a relay base and an isolator base designed for style 7 applications.

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Fire Alarm Control Unit:
   1. System Capacity: 4,064 addresses; six (expandable to 192) notification appliance circuits (NACs); four input/output (I/O) circuits; 1,500 software zones.
   2. Features: Strobe synchronization; dedicated alarm, supervisory and trouble relays; 4,000 event history buffer; built-in IP communicator; Ethernet port for programming and network connectivity; e-mail system status, reports and event information.

D. Addressable Modules:
   1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
   2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
   3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
   4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
   5. Releasing Control Modules: Provide as indicated or as required for control of listed solenoids in releasing applications.
   6. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
   7. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.

8. Products:
    a. Ruskin Company; ADC105 Addressable Damper Controller for Simplex Panels: www.ruskin.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

E. Initiating Devices:
1. Addressable Systems:
    a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
    b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

F. Manual Pull Stations: Comply with UL 38. Boxes shall be finished in red with molded, raised- letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

G. System Smoke Detectors
1. General Requirements for System Smoke Detectors:
    a. Comply with UL 268, current accepted edition operating at 24-V dc, nominal.
    b. Detectors shall be two-wire type,
    c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
    d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
    e. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
    f. Integral Visual-Indicating Light: LED type, indicating detector has operated and communication status.
    g. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    h. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    i. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    j. Multiple levels of detection sensitivity for each sensor.
    k. Sensitivity levels based on time of day.
    l. If any specialized equipment must be used to program any function of the smoke detector devices, then one must be furnished as part of the system.

H. Photoelectric Smoke Detectors

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present average value, present sensitivity selected, and sensor range (normal, dirty, etc).

I. Duct Smoke Detectors: Photoelectric type complying with UL 268A
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present average value, present sensitivity selected, and sensor range (normal, dirty, etc),
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Auxiliary function control is to be by discrete addressable control relay.

J. Projected Beam Smoke Detectors
1. Projected Beam Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.
2. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.
3. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present average value, present sensitivity selected, and sensor range (normal, dirty, etc.).

K. Carbon Monoxide Detectors
1. General: Carbon monoxide detector listed for connection to fire-alarm system.
2. Mounting: Adapter plate for outlet box mounting.
    a. Testable by introducing test carbon monoxide into the sensing cell.
    b. Detector shall provide alarm contacts and trouble contacts.
    c. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
    d. Comply with UL 2075.
    e. Locate, mount, and wire according to manufacturer's written instructions.
    f. Provide means for addressable connection to fire-alarm system.
    g. Test button simulates an alarm condition.

L. Multi-Criteria Detectors
1. Mounting: Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.
4. Test button tests all sensors in the detector.
5. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present sensitivity selected, and sensor range (normal, dirty, etc.).
6. Sensors: The detectors shall comply with UL 268 7th edition.

M. Non-System Smoke Detector

N. a. General Requirements for Non-system Smoke Detectors
   a. Non-system smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
   b. Non-system smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

O. Heat Detectors
   1. General Requirements for Heat Detectors: Comply with UL 521.
      a. Temperature sensors shall test for and communicate the sensitivity range of the device.
      b. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
         1) Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
         2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
      c. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
         1) Mounting: Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
         2) Integral addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
      d. Continuous Linear Heat-Detector System:
         1) Detector Cable: Rated detection temperature 155 deg F (68 deg C). Listed for "regular" service and a standard environment. Cable includes two steel a actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.
         2) Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
         3) Signals to Fire-Alrm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
         4) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

P. Notification Appliances
   1. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
   2. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
   3. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
   4. Visible Notification Appliances: visuals complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

a. Rated Light Output: 15/30/5/110/177 per drawings and field selectable.
b. Mounting: Wall mounted unless otherwise indicated.
c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
d. Flashing shall be in a temporal pattern, synchronized with other units.
e. Visuals Leads: Factory connected to screw terminals.
f. Mounting Faceplate: Factory finished, [red] [white].

Q. Remote Annunciator
1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
a. Mounting: Flush or Surface as indicated on the Drawings cabinet, NEMA 250, Type 1.
b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

R. DIGITAL ALARM COMMUNICATOR TRANSMITTER
1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically connect to a communications path and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on the path is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of path to the remote alarm receiving station over the remaining path. Transmitter shall automatically report service restoration to the central station. If service is lost on both communication paths, transmitter shall initiate the local trouble signal.
3. 3. Local functions and display at the digital alarm communicator transmitter shall include the following:
a. Verification that all paths are available.
b. b.Programming device.
c. LED Display.
d. Manual test report function and manual transmission clear indication.
4. Communications failure with the central station or fire-alarm control unit.
5. Digital data transmission shall include the following:
a. Address of the alarm-initiating device.
b. Address of the supervisory signal.
c. Address of the trouble-initiating device.
d. Loss of ac supply.
e. Loss of power,
f. Low battery.
g. Abnormal test signal.
h. Communication bus failure.
6. Secondary Power: Integral rechargeable battery and automatic charger.
7. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

S. Radio Alarm Transmitter
1. Transmitter shall comply with NFPA 1221 and 47 CFR 90.
2. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.

b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
c. Normal Power Input: 120-V ac.
d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
g. Antenna-Cable Connectors: Weatherproof.
h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

3. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions.
a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
f. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

T. MAGNETIC DOOR HOLDERS
1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
2. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
3. Wall-Mounted Units: Flush mounted unless otherwise indicated.
4. Rating: 24-V dc.
5. The electromagnets shall be controlled by the FACU. Individual smoke detector auxiliary contacts shall not be used to release door holders.
6. Material and Finish: Match door hardware

U. Device Guards
1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
2. Factory fabricated and furnished by device manufacturer.
3. b. Finish: Paint of color to match the protected device.

V. Circuit Conductors:

1. Building wire - 14 AWG copper minimum. NAC circuits for speakers shall use conductors 14 AWG minimum, shielded and jacketed, plenum rated; provide 500 feet (60 m) extra; color code and label or each IDC and NAC conductor type.
2. MC-FPLP Cable-Type THHN/THWN Insulated Copper #14 AWG minimum stranded and/or Type TFN Insulated 16/2 AWG minimum copper. Green insulated or tinned copper grounding conductor. UL Listed as Type MC and Type FPLP. 600 Volt Type MC and 300 Volt Type FPLP. Rated VW-1. Red Lightweight Aluminum Interlocked Armor.

W. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

X. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
2. Provide a different standard lock and key for each key operated alarm initiating device; provide 25 keys of each type.

Y. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

Z. Storage Cabinet for Documentation: Steel with baked enamel finish, size appropriate to quantity of paper. Provide as required by NFPA 70.
1. Locate and clearly label within room of FACP.
2. Locate as directed by Edmonds Engineering, Inc.

AA. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

B. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

C. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.02 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems".

B. Devices placed in service before all other trades have completed cleanup shall be replaced.

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
   1. Connect new equipment to existing control panel in existing part of the building.
   2. Expand, modify, and supplement existing control or monitoring equipment as necessary to extend existing control or monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

D. Equipment Mounting: When Seismic compliance required.
   1. Install seismic bracing. Comply with requirements in Section 270548.16 "Seismic Controls for Communications Systems".
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (460-mm) centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

F. Manual Fire-Alarm Boxes:
   1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
   2. Mount manual fire-alarm box on a background of a contrasting color.
   3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

G. Smoke- or Heat-Detector Spacing
   1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
   2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet (9m).
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
   5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
   6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
   7. When installed in a room, detectors shall be oriented, so their alarm light is visible from the nearest door to the corridor.

H. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends. All air duct/plenum detectors must have a RAIL located in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. The label shall have the device address, function, and room location. These detectors shall be installed in a manner that provides suitable access for required periodic cleaning and calibration.
   1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

J. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with rear support. The preferred method for doing this is to have the tube go through the far side of the duct, with the point of penetration tightly sealed to prevent air leakage around the tube. This facilitates smoke testing and tube cleaning. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The Contractor shall mark the direction of air flow on the duct at each duct detector location. Each duct detector installation shall have a hinged or latched access panel, 12”x12” minimum, for sampling tube inspection and cleaning. Coordinate with Mechanical Contractor.

K. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

L. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

M. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

N. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

O. Remote Alarm Indicating Light (RAIL): Visible Alarm-Indicating Devices: Install as indicated on drawings and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
   1. Remote Alarm Indicating Lights (RAIL): Locate in public space near the device they monitor. RAILS shall be labeled with device address, function and room location of device monitored.
   2. RAILs shall be provided with a key switch for testing of the duct detectors.

P. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists [100-mph (160-km/h)] wind load with a gust factor of 1.3 without damage.

Q. Auxiliary Function defeat switches: Provide supervised “Auxiliary Function Defeat” toggle switches in the FACU for AHU, doors, elevators, notification, off premise reporting and others as owner requests. NOTE: Water flow bells are not to defeated. Provide an informative label at switch indicating “Normal” position. The switch must cause a system “trouble” indication when it is placed in the off (“Function Defeated”) position. An Auxiliary Function defeat shall cause defeat, or when released allow restoral of the function at any point prior to or during the alarm event.

R. Surge Protection Device (SPD): The system shall be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. The devices are to be provided by the fire alarm equipment supplier:
   1. On AC Input of all panels: A feed-through (not a shunt-type) branch circuit transient arrestor. The SPD shall meet current electrical code for use on fire alarm equipment and have NRTL listings. Install in a listed enclosure near the electrical panelboard and trim excess lead lengths. Wind small coil in the branch circuit conductor, within panelboard, downstream of the suppressor connection. Coil is to be about 1" diameter, 5 to 10 turns, and tie-wrapped.

2. On DC Circuits Extending Outside Building: Adjacent to the FACU, and also near point of entry to outlying building, provide "pi"-type filter on each leg, consisting of a primary arrestor, series impedance, and a fast-acting secondary arrestor which clamps between 30 and 40 Volts. Use models recommended by the Original Equipment Manufacturer (OEM).

S. FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION
1. Installation of the FACU and connection of all circuits shall be performed by persons meeting requirements listed in the Quality Assurance paragraph. All connections at the FACU must be made by the Manufacturer's authorized, factory trained representative (rather than by the electrical contractor).
2. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

T. The installing contractor will submit programmed point descriptors for owner preliminary approval. The approved descriptors will be programmed into the system before system testing to allow field verification. Final descriptor updates will be based on final testing review.

3.03 FIELD DEVICE LABELING

A. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

B. The location of all End of Line devices shall be labeled on the device, with NAC panel number and NAC circuit number. All notification devices shall be labeled.

C. The label will be permanently mount on each device so that it's readable standing on the floor below.

D. Devices above ceilings will have labels attached to the ceiling at location of access.

E. If the device is an isolator, then ISO will be a part of the label.

F. Pull stations will have the address on the top or front face.

G. Connections or cables in the FATC (FAJB) will be labeled with circuit numbers. Raceways feeding the FATC will be labeled with function / area served. 5th floor north, FATC 4th floor etc. Wires may be numbered with a printed schedule mounted in the FATC.

3.04 PATHWAYS

A. Pathways shall be installed concealed above accessible ceilings. Pathways in non-accessible locations may be routed exposed where noted or routed in Type MC-FPLP cable to assist in installation. Splices shall not be made between devices.

B. Circuit conductor pathways for building wire shall be installed in EMT.

C. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

D. New EMT shall be identified as described in Section 260553. Existing raceway that is reused shall be marked every 10 feet with a red band or label stating fire alarm.

E. Class A SLC riser shall be run in two (2) separate conduits. Each leg of the circuit of the circuit shall be separated by a minimum of two (2) hour fire resistance rated construction, as shown on the drawings, and arranged such that severing one of the conduits will not put any portion of the system out of service. Should a two hour (2) separation be determined impractical by the COR or appointed representative, a physical separation distance of not less than 1 foot on a vertical plane and not less than 4 feet on a horizontal plane shall be achieved.

3.05 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

B. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

C. Cable Splices: Any and all cable splices shall be in hinged terminal cabinets only. No splicing of conductors in outlet or junction boxes. There shall be NO splices in the system other than at terminal blocks. "Wire nuts," crimp splices, or insulation piercing type connectors are not acceptable. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. Permanent wire markers shall be used to identify all splices and terminations for each circuit. For splices, use markers or other means to indicate which conductors leads to the FACU.

D. Detection or alarm circuits shall not be installed in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated from other circuits and the enclosure must have an appropriate warning label to alert service personnel to the potential hazard.

E. Provide an engraved label on FACP and all notification appliance circuit expansion panels identifying its 120 VAC power source. This label shall include panelboard identification and circuit number and panelboard location. This information shall also be provided inside panels.

F. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device and shown in system drawings.
   1. Smoke dampers in air ducts of designated HVAC duct systems.
   2. Magnetically held-open doors.
   3. Electronically locked doors and access gates.
   4. Alarm-initiating connection to elevator recall system and components.
   5. Alarm-initiating connection to activate emergency lighting control.
   6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
   7. Supervisory connections at valve supervisory switches.
   8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
   9. Supervisory connections at elevator shunt-trip breaker.
   10. Data communication circuits for connection to building management system.
   11. Supervisory connections at fire-extinguisher locations.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems”.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.07 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.08 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by [Architect] [authorities having jurisdiction]

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections

C. Perform tests and inspections.

D. Perform the following tests and inspections:
   1. Visual Inspection: Conduct visual inspection prior to testing.

E. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

1. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
6. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
7. Fire-alarm system will be considered defective if it does not pass tests and inspections.
8. Prepare test and inspection reports.
9. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
10. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.09 DEMONSTRATION

A. Train owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Multiple training sessions will be provided to meet owner’s needs for multiple shift training. Training sessions will include testing for retention of training.

3.10 TESTING

A. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

B. Minimum System Tests: Minimum test shall be a 100% operation test including, but not limited to the following:

C. Verify the absence of unwanted voltages between circuit conductors and ground.

D. Test all conductors for short circuits using an insulation-testing device.

E. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.

F. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.

G. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

H. Test all initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

I. All circuits shall be tested for supervision. “Class A” Signal Line Circuits shall be tested for “Class A” operation.

J. All sprinkler devices shall be tested for alarm, supervisory and trouble situations.

K. All control circuits (AHU shutdown, door holders, dampers) shall be tested for proper operation on an alarm condition and for wire supervision.

L. Elevator recall function shall be tested to ensure proper recall programming.

M. Check zone map for proper location of all devices. Verify that devices and wire are properly labeled. Verify that program descriptors match device location. Verify EOL locations with as built drawings.

N. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

O. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

P. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests. Provide documentation of specific examples of the various tests via FACU event logs or other data capture means.

Q. Engineer's Test: After the pretest has been completed and the system is clear of trouble all test documentation including a printout of all custom labels and a NFPA 72 "Record of Completion" form shall be submitted to Engineer for approval. At that time Engineer may, at his discretion, perform a 100% functional test of the fire alarm system. The Contractor and the Manufacturer's authorized representative that installed the system must be present. Should the results of this test not be satisfactory, then corrections will be made, and a re-test will be required at the Contractor's expense.

R. Authority Having Jurisdiction Inspection/Test: Only after Engineer has approved the system the design professional will schedule the inspection. The Contractor and the Manufacturer's authorized representative must be present for test. Provide a minimum of 10 days' notice in writing to the Engineer for the Authority Having Jurisdiction Inspection/Test.

S. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.

T. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

U. Closeout: After successful completion of inspections and tests, the warranty period begins. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove and replace the system.

V. All System documentation shall be provided and housed in a Documentation Cabinet at the control panel or other approved location.

3.11 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
   3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:

1. Initial Training: 1 session pre-closeout.
2. Refresher Training: 1 session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
1. Initial Training: 1 session pre-closeout.
2. Refresher Training: 1 session post-occupancy.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
1. Initial Training: 1 session pre-closeout.
2. Refresher Training: 1 session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
1. Initial Training: One 3-day session, pre-closeout.
2. Refresher Training: One 1-day session post-occupancy.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.12 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
6. Occupancy permit has been granted.
7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.13 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within [two] years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.14 MAINTENANCE

A. See Section 017000-=Execution and Closeout Requirement, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by trained employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

D. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.

E. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   4. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   5. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   6. Record keeping required by NFPA 72 and authorities having jurisdiction.

F. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

G. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

H. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

I. Comply with Owner's requirements for access to facility and security.

END OF SECTION 284600

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SECTION 31 0000

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparing of subgrade and grading for buildings, slabs, walks, embankments, slopes and pavements.
2. Excavating and backfilling of utility trenches.

B. Related Documents
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Base Material:
1. Basis of Measurement: Cubic Yard
2. Basis of Payment: Includes all labor, material, and equipment associated with placing the specified base material in accordance with the requirements outlined in this Section and/or in the Plans.

B. Aggregate:
1. Basis of Measurement: Cubic Yard
2. Basis of Payment: Includes all labor, material, and equipment associated with placing the specified aggregate material in accordance with the requirements outlined in this Section and/or in the Plans.

C. Structural Fill:
1. Basis of Measurement: Cubic Yard
2. Basis of Payment: Includes all labor, material, and equipment associated with placing structural fill material in accordance with the requirements outlined in this Section and/or in the Plans.

D. General Fill:
1. Basis of Measurement: Cubic Yard
Basis of Payment: Includes all labor, material, and equipment associated with placing general fill material in accordance with the requirements outlined in this Section and/or in the Plans.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO R 18 – Establishing and Implementing a Quality System for Construction Materials Testing Laboratories.

ASTM International:
2. ASTM D 698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D 1556 – Standard Test Method for Density and Unit Weight of Soil in place by the Sand-Cone Method
4. ASTM D 1557 – Standard Test Method for Laboratory Compaction

Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

5. ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D 2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (shallow depth).
7. ASTM D 2937 – Standard Test Method for Density of Soil in Place by the Drive- Cylinder Method
8. ASTYM D 3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (shallow depth).
9. ASTM D 4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
10. ASTM D 4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating.
11. ASTM D 6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
12. ASTM D 7830 Standard Test Method for In-Place Density and Water Content of Soil Using an Electromagnetic Soil Density Gauge

1.4 DEFINITIONS

A. Excavation: Removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Engineer.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will evaluate conditions. If Engineer determines that bearing materials at required subgrade are unstable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

D. Subgrade: The undisturbed soil or rock, or the compacted fill layer immediately below structures, granular base, drainage fill, or topsoil materials.

E. Structures: Buildings, foundations, slabs, tanks, pavements, gravel drives or road, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.

F. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.

G. Structural Fill: Materials placed as fill in Structural Areas.

1.5 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Materials Source: Submit name of imported materials source.

C. Test Reports: All test reports must be completed under the supervision of a registered engineer, licensed in the state in which the project is located. Contractor will notify testing agency a minimum of 24 hours prior to performing work that requires testing. Submit the following test reports directly to Engineer, with copy to Contractor:

1. Test reports on borrow material. (ASTM D-2487, 4318, 6913)
2. Verification of each foundation bearing surface in accordance with specified requirements.
3. Field reports of in-place density tests.
4. One optimum moisture-maximum density curve for each type of soil encountered. (ASTM D-698 or ASTM D-1557)
5. Subgrade evaluation report for all structural areas prior to fill placement and after establishing final subgrade, but prior to pavement or building slab construction.

1.6 QUALITY ASSURANCE

A. Furnish each soil material from single source throughout the Work.

B. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

C. Testing and Inspection Service: Contractor will employ and pay for a qualified independent geotechnical testing and inspection laboratory in accordance with City of Gadsden Division 105-General Conditions to perform soil testing and inspection service during earthwork operations. Laboratory shall be selected by the Engineer.

D. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to AASHTO R18, that it has the experience and capability to conduct the required field and laboratory geotechnical testing.

1.7 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports (if performed) was used for the basis of the design and are available to the Contractor for information only. Conditions noted in the report(s) are not intended as representations or warranties of accuracy or

continuity between soil borings. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and

utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner at no expense to the Owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

   a. Provide minimum of 48-hour notice to Engineer and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active. Resultant excavations must be backfilled in lifts and tested in accordance with the project requirements.

C. Use of Explosives: Use of explosives is not permitted.

D. Jobsite safety and conformance to applicable codes and guidelines to protect persons and property is solely the responsibility of the contractor.

1. Excavate in accordance with OSHA guidelines. Barricade open excavations.
2. Operate safety barriers, markings and warning lights as required to maintain a safe work environment and as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 PRODUCTS

A. Base Material: Naturally or artificially graded mixture of crushed gravel or stone, sand or select granular materials conforming to the Department of Transportation requirements for the state in which the project is located.

B. Aggregate: Graded fine or coarse aggregates as specified in Section 31 05 16.

C. Structural Fill: On or off-site soil free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material shall have a liquid limit of 55 or less, a plasticity index of 30 or less, less than 30% rock fragments retained on a ¾" sieve, and a maximum dry density of at least 100 pcf. May also consist of Aggregate Type A2, Type A3 or Crushed Aggregate Base Course.

B. General Fill: On or off-site soil and/or rock which is stable and can be compacted to the specified density. Rock fragments shall be less than 4 inches in largest dimension and blended with sufficient fines to create a dense fill mass free of visible voids.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas as

directed by the Engineer.

B. Stockpile excavated material meeting requirements for satisfactory soil materials and topsoil materials.

C. Remove excess excavated material not intended for reuse from site.

D. Excavate to subgrade elevations or cut line as indicated, regardless of character of materials and obstructions encountered, including rock, existing structures, and utilities. Subsurface materials are unclassified.

3.2 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.

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

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2’-6” below final grade and leave permanently in place.

3.3 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations or in foundation excavations prior to or following footing construction. Remove water to prevent softening of foundation boring soils, undercutting footings, and soil changes detrimental to stability of the subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
3. Dewater excavations only as necessary for suitable construction. Do not continue dewatering overnight or for an extended period of time except as required.

3.4 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage. Stabilize in accordance with ADEM and NPDES regulations.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip

line of trees indicated to remain.

2. Dispose of excess excavated soil material and materials not acceptable for reuse as backfill or fill.

3.5 EXCAVATION FOR STRUCTURES

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

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim sides and bottom to required lines and grades. Compact with hand or remote operated equipment to leave solid base to receive other work.
2. For pile foundations, stop excavations from 6 inches to 12 inches above bottom of cap before piles are placed. After piles have been placed, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavations for soil supported foundations must be neat, clean and dry. Remove loose, disturbed and soft soil. Dewater only as necessary for proper construction.

3.6 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 36 inches total width.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on structural fill or undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. For pipes or conduit in all other soil conditions, refer to Section 31 23 16 – Utility Trenching.

3.8 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

B. Do not place frozen soil fill.

3.9 BACKFILL AND FILL

A. General: Place soil material in uniform, horizontal lifts as required to final subgrade elevations. Compact individual lifts uniformly to specified density prior to placing the subsequent lift. For each area classification listed below, use materials specified in Part 2 of the Section.

1. In non-structural areas, use general fill. The final lift shall be the required thickness of topsoil.
2. In structural areas, use structural fill or aggregate. The final lift shall be as indicated on the plans.
3. Under utilities, use aggregate as indicated on the plans in areas determined by the Engineer to be unsuitable for pipe bedding. Shape excavation bottom to fit bottom 90

degrees of cylinder.

4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings or that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
   a. Concrete is specified in Section 03 30 00.
   b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
5. Provide 4-inch-thick concrete base slab support for piping or conduit less than 24" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove undocumented fills, vegetation, debris, topsoil, obstructions, underground structures (foundations, slabs, walls and utilities), and deleterious materials from area prior to placement of fills. Backfill disturbed areas with compacted and tested fill. Contractor shall notify Engineer to evaluate the natural ground prior to fill placement. Where access permits, Contractor shall provide pneumatic-tired equipment capable of producing the pressure equal to that produced by a fully-loaded, tri-axle dump truck for use in evaluation.

1. When existing ground exhibits instability, scarify ground surface, moisture- condition to within 2% of the optimum moisture content, and compact to the project requirements. Alternatively, remove and replace unstable soils with suitable, compacted soils or stabilize at the direction of the Engineer.
2. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Benches shall consist of alternating horizontal and vertical soil surfaces in the original ground with horizontal benches no more than 5 feet apart vertically.
3. Overbuild slopes and cut back to the desired configuration to ensure the soils at the slope face are properly compacted and tested.

B. In structural areas, place structural fill or aggregate in layers not more than 8 inches in loose thickness for material compacted by heavy compaction equipment, and not more than 4 inches in loose thickness for material compacted by hand-operated tampers. In non- structural areas, place general fill in maximum 24" thick lifts.

C. In structural areas, before compaction, moisten or aerate each layer of fill as necessary to provide moisture content within the fill at ±2% of the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place structural

fill on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Standard Proctor Density Requirements:
   a. Structural Areas: Compact each individual lift of structural fill and fine aggregate to not less than 98% of the maximum standard Proctor density in accordance with ASTM D-698. Compact each individual lift of coarse aggregate using multiple passes of a vibratory compactor or as directed by the Engineer.
   b. Non-Structural Areas: Compact each individual lift using multiple passes of a compactor designed for the type of soils used as fill or backfill.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
   a. Remove and replace, or scarify and air dry soil material that is too wet to permit compaction to specified density.
   b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition area. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade, and cross- section, with finish surface not more than ½ inch above or below required subgrade elevation.

C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 PAVEMENT BASE COURSE

A. General: Base course consists of placing base material in layers of specified thickness, over subgrade surface to support a pavement base course.

1. Refer to other Division 2 sections for paving specifications.

B. Grade Control: During construction, maintain lines and grades including crown and cross- slope of base course.

C. Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12-inch width of shoulder simultaneous with the compaction and rolling of each layer of base course.

D. Placing: Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.

1. When a compacted base course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches when compacted.
2. Compact individual lifts of the base to a minimum of 100% of the ASTM D-1557 maximum dry density at ±2% of the optimum moisture content.

3.13 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placing aggregate in layers of indicated thickness over subgrade surface to support concrete building slabs.

B. Placing: Place aggregate on prepared subgrade in layers of uniform thickness, conforming to the indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 6 inches or less than 3 inches when compacted.
2. Compact the individual lifts of the drainage course with a vibratory compactor as directed by the Engineer.

3.14 FIELD QUALITY CONTROL

A. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be paid for using the testing allowance for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.

B. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from

the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

C. Quality Control Testing During Construction: Allow testing service (to be selected by Engineer) to test each subgrade and fill layer before further backfill or construction work is performed.

1. Perform field density tests on each lift of fill in accordance with ASTM D 2937 (Drive Cylinder Method), ASTM D 2922 (Nuclear Method), ASTM D 7830 (Electromagnetic Method), or ASTM D 1556 (sand cone method).

a. In conjunction with each density test, the natural moisture content shall be

determined in accordance with ASTM D 3017 (nuclear method), ASTM D 4959 (direct heating), ASTM D 7830 (electromagnetic method) or other method approved by the Engineer.

b. If field tests are performed using nuclear or electromagnetic methods, make calibration checks using alternate methods of both density and moisture results on each different type of material encountered and at intervals as directed by the Engineer.

2. Footing Subgrade: For all soil on which footings will be placed, perform tests to verify required design bearing capacities. Engineer shall be notified to observe and approve each footing subgrade. Engineering evaluation may include the excavation of hand augers or test pits. The contractor shall provide suitable equipment to excavate test pits as directed by the Engineer.
3. Paved Areas and Building Slab Subgrade: Perform at least one field density test per lift for every 2,500 sq. ft. of area, but in no case fewer than three tests.
4. Foundation Wall Backfill: Perform at least two field density tests on each lift of fill placed at locations directed by the Engineer.

D. If in opinion of Engineer, based on testing reports or Engineering judgement, subgrade or fill that have been placed are unsuitable, perform additional compaction and testing until specified density is obtained. Do not place additional fill over materials that have not been approved by the Engineer. Work to recompact and retest unsuitable areas will be at the expense of the contractor.

3.15 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction and/or as described in the Plans.

B. Unless otherwise specified in the Plans, the contractor is responsible to apply for and obtain any required permits in the contractor's name associated with current NPDES guidelines. Requirements for implementing and maintaining an acceptable Best Management Practices Plan shall be the responsibility of the contractor. The contractor is responsible to maintain the NPDES permit in good standing with the regulatory authority and comply with applicable NPDES regulations during construction, and terminate permit upon completion and approval at no additional cost to the owner.

3.16 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated

material, trash, and debris, and dispose of it off Owner's property.

1. Secure a disposal site and all necessary approvals for use.
2. Remove excess excavated material, trash, debris, and waste materials and dispose of it off Owner's property.
3. Excavated material in area noted on plans shall be screened by geotechnical engineer. If classified "contaminated", it shall be stockpiled and monitored by the contractor at no additional cost.

END OF SECTION

SECTION 31 0516

AGGREGATE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.

2. Fine aggregate materials.

B. Related Sections:

1. Plans and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil- Aggregate Subbase, Base and Surface Courses.

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement: Cubic yard or as indicated in the Plans and/or Bid Form

B. Basis of Payment: Includes all labor, materials and equipment for the installation of aggregate including hauling, placing, spreading, grading to the proper level, cleanup and all related items.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Samples: Submit 10-gallon sample of each type of aggregate to testing laboratory.Materials

Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 **COARSE AGGREGATE MATERIALS**

A. Coarse aggregate shall consist of crushed gravel or stone having hard, strong, durable pieces, free from adherent coatings.

B. Coarse Aggregate Type A1 (ALDOT Aggregate size No. 4) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	100
1-1/2 inch	90 to 100
1 inch	20 to 55
3/4 inch	0 to 15
1/2 inch	-----
3/8 inch	0 to 5
No. 4	-----
No. 8	-----
No. 16	-----
No. 50	-----
No. 200	-----

C. Coarse Aggregate Type A2 (ALDOT Aggregate size No. 57) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	-----
1-1/2 inch	100
1 inch	95 to 100
3/4 inch	-----
1/2 inch	25 to 60
3/8 inch	-----
No. 4	0 to 10
No. 8	0 to 5
No. 16	-----
No. 50	-----
No. 200	-----

D. Coarse Aggregate Type A3 (ALDOT Aggregate size No. 78) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	-----
1-1/2 inch	-----
1 inch	-----
3/4 inch	100
1/2 inch	90 to 100
3/8 inch	40 to 75
No. 4	5 to 25
No. 8	0 to 10
No. 16	0 to 5

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type A4 (Concrete Sand): Washed sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 90
No. 50	5 to 30
No. 100	0 to 10

B. Fine Aggregate Type A5 (Natural Sand): Natural sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95 to 100
No. 8	----
No. 16	50 to 80
No. 50	20 to 50
No. 100	10 to 25
No. 200	5 to 12

2.3 SOURCE QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate aggregate materials from on-site locations as specified in Section 31 00 00.

B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

A. Stockpile materials on site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 1000

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing surface debris.
2. Removing designated paving, curbs, and culverts.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

A. Conform to applicable codes for environmental requirements, disposal of debris, burning debris on site, use of herbicides, and disposal of sludge.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

A. Call Alabama One Call service at 1-800-292-8525 or 811 not less than three working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain.

C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches.

B. Remove trees and shrubs within indicated areas. Remove stumps, surface rock, and fences.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs, and gutters. Neatly saw cut edges at right angle to surface.

C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.7 SITE RESTORATION

A. Restore all areas disturbed by the construction activities to pre-construction conditions or better.

B. Restore areas to satisfaction of Owner and Land Owner if work has occurred on private property.

C. If preconstruction documentation of existing conditions has not been performed, restore areas to complete satisfaction of Owner and Land Owner at no additional cost to Owner.

D. Restore paved or unpaved streets, roads, sidewalks, curbs, etc. disturbed by the construction activities to preconstruction conditions or better using materials and workmanship conforming to requirements of Owner, City or Alabama Department of Transportation, whichever applies.

E. Maintain seeded areas and re-seed as needed until a stand of grass satisfactory to the Owner is established.

END OF SECTION

SECTION 31 2316

UTILITY TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities.
2. Backfilling and compaction.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement and Payment shall be as outlined in Sections related to the specific Utility being installed.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand- Cone Method.
4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Structures: Buildings, foundations, slabs, tanks, pavements, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.

C. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.

D. Structural Fill: Materials placed as fill in Structural Areas.

1.5 SUBMITTALS

A. Product Data: Submit data for geotextile fabric indicating fabric and construction.

B. Materials Source: Submit name of imported fill materials suppliers.

1.6 QUALIFICATIONS

A. Prepare erosion control plan and submit to Engineer prior to start of construction.

B. Refer to Section 31 25 00, Erosion Control Devices.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General fill: As specified in Section 31 00 00.

B. Aggregate Fill: As specified in Section 31 00 00, Section 31 05 16, and the Plans.

C. Structural Fill: As specified in Section 31 00 00.

D. Concrete: Structural conc.as specified in Section 03 30 00 w/ compressive strength of 3,000 psi.

E. Lean Concrete: Non-structural concrete with a compressive strength of 2,000 psi.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

C. Maintain proper horizontal alignment of utilities not laid on grade.

3.2 PREPARATION

A. Call Alabama One Call service at 1-800-292-8525 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding

construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right- of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Erect erosion control devices prior to excavation.

B. Excavate subsoil required for utilities to the depth indicated on the Drawings.

C. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume.

D. Perform excavation within 24 inches of existing utility in accordance with utility's requirements.

E. Do not advance open trench more than 400 feet ahead of installed pipe.

F. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 12 inches of clearance on each side of pipe or conduit.

G. Remove water or materials that interfere with Work.

H. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

I. Do not interfere with 45 degree bearing splay of building foundations or roadbeds.

J. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A1 and compact to density equal to or greater than requirements for subsequent backfill material.

L. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with concrete as directed by Engineer.

M. Remove excess subsoil not intended for reuse, from site.

N. Maintain trench depth sufficient to provide a minimum cover of 30 inches over utility pipe unless otherwise noted in the Drawings. Maintain a minimum of 36 inches cover under highway ditches.

3.4 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.

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

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2’-6” below final grade and leave permanently in place.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches as follows:

1. In non-structural areas, use excavated material to backfill to existing contours and elevations, unless such material does not conform to the requirements of General Fill as outlined in Section 02300. In such instances, borrow material meeting those requirements shall be brought in to backfill the trench. The final lift shall be the required thickness of topsoil.

2. In structural areas, use structural fill as shown on the Plans or as directed by the Engineer. Backfill to elevations reflected on the plans, or to match surrounding grade. The final lift shall be as indicated on the plans. If subgrade is unstable, prepare subgrade beneath pipe in accordance with Section 31 00 00 prior to fill placement.

3. Use aggregate as indicated on the plans in areas determined by the Engineer to be unsuitable for pipe bedding. Shape excavation bottom to fit bottom 90 degrees of cylinder.

4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings or that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

a. Concrete is specified in Section 03 30 00.

b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or

displacement of pipe systems.

5. Provide 4-inch-thick concrete base slab support for piping or conduit less than 24” below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.

B. Place, moisture condition, and compact fill material in accordance with Section 31 00 00.

C. Employ placement method that does not disturb or damage utilities in trench, or structures near the trench.

D. Do not leave trench open at end of working day.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 2500

EROSION CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silt Fences.
2. Diversion Channels.
3. Rock Energy Dissipater.
4. Paved Energy Dissipater.
5. Rock Basin.
6. Rock Barriers.
7. Sediment Ponds.
8. Sediment Traps.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:
1. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:
1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit data on joint filler joint sealer and geotextile.

C. Submit Erosion Control Plan along with application for Stormwater NPDES permit to Engineer prior to placement of erosion control devices.

D. Submit manufacturer's catalog sheets and other pertinent information on filter fabrics showing that they meet or exceed the requirements of this specification.

1.4 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105 - General Conditions

1.5 ENVIRONMENTAL REQUIREMENTS

A. City of Gadsden Division 105 - General Conditions

B. Do not place grout when air temperature is below freezing.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

D. Silt fence should not be installed across streams, ditches, waterways, or other concentrated flow areas.

PART 2 PRODUCTS

2.1 SILT FENCE MATERIALS

A. Geotextile fabric shall be a 36" wide, nonwoven filter fabric composed of polypropylene, polyethylene, ethylene, or polyamide material.

B. Minimum grab strength shall be 100 lbs. in any direction.

C. Apparent opening size shall be 30 (maximum sieve size).

D. Flow rate shall be 25 gallons/minute/square foot.

E. Ultraviolet ray inhibitors and stabilizers shall provide a maximum of 6 months of expected usable life.

F. Type A silt fence shall include a 36" wide, 12-1/2 gauge galvanized wire fence reinforcement to be placed with the geotextile material. Wire fence shall have openings no larger than 6 inches by 6 inches. Type B silt fence shall be a 36" wide fabric with no wire fence reinforcement.

G. Fence posts shall be minimum 2" x 2" oak, 60" long or steel T-post for Type B silt fence. Steel T-posts or 4" x 4" pressure treated wood posts shall be required for Type A silt fence. Minimum bury depth for wood posts is 24 inches.

2.2 ROCK (Not Used)

2.3 CONCRETE MATERIALS AND REINFORCEMENT

A. Concrete: As specified in Section 32 16 00.

B. Water: Clean and not detrimental to concrete.

C. Reinforcement Steel: As specified in Section 32 16 10.

2.4 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

A. Precast Solid Concrete Block.

B. Soil Backfill: Soil as specified in Section 31 00 00

2.5 PLANTING MATERIALS

A. Seeding and Soil Supplements: refer to BMP notes in Plans Sheet C-101

B. Mulch: refer to BMP notes in Plans Sheet C-101.

2.6 PIPE MATERIALS

A. Pipe: Corrugated Plastic (HDPE).

2.7 SOURCE QUALITY CONTROL (AND TESTS)

A. City of Gadsden Division 105 - General Conditions

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

C. Make rock available for inspection at producer's quarry prior to shipment. Notify Engineer at least seven days before inspection is allowed.

D. Allow witnessing of inspections and testing at manufacturer's test facility. Notify Engineer at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105 - General Conditions

B. Verify location of existing streams, drainage structures and environmentally sensitive areas prior to placing erosion control devices.

C. Verify compacted subgrade, granular base or stabilized soil is acceptable and ready to support devices and imposed loads.

D. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SILT FENCE

A. The silt fence should be purchased in a continuous roll cut to length to avoid the use of joints. When joints are unavoidable, fabric should be spliced together at a post with a minimum 6 inch overlap.

B. Post installation should start at the center of the low point with remaining posts spaced 10 feet apart for Type A and 7 feet apart for Type B fence.

C. Anchor fabric by entrenching the bottom edge in a 6 inch deep trench and backfilling.

D. Hay or straw bales shall be placed at each end of the silt fence.

3.3 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density.

C. On entire channel area, apply soil supplements and sow seed as per BMP notes in Plans Sheet C-101..

D. Mulch seeded areas with hay as per BMP notes in Plans Sheet C-101.

3.4 ROCK ENERGY DISSIPATOR

Excavate to indicated depth of rock lining or nominal placement thickness as follows. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

NCSA Class	Nominal Placement Thickness
R8	48 inches
R7	36 inches
R6	30 inches
R5	24 inches
R4	18 inches
R3	12 inches

A. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than 4 weeks.

B. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.

C. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.
   1. Saturate rock with water. Fill voids between pieces with grout, for at least top 6 inches. Sweep surface with stiff broom to remove excess grout.
   2. Moist cure grouted rock for at least 3 days after grouting, using water saturated burlap in accordance with Section 03 30 00.

3.5 PAVED ENERGY DISSIPATER

A. Excavate to the required paving depth. Remove loose, unsuitable material below bottom of paving, and then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

B. Place forms and hold reinforcement firmly in position during placing of concrete.

C. Mix, place and finish concrete, as specified in Section 32 16 00.

D. Embed stones or blocks 4 inches in plastic concrete at indicated separation on slopes and channel bottom.

E. Pave in uniform 10 foot lengths or sections.

F. Pave in shorter sections as necessary for closures or curves.

G. Place premolded expansion joint filler, 1/2 inch thick, cut to conform to paving cross sections, at ends of curved sections at intervals of not more than 100 feet, at end of day's work, and where paving is adjacent to rigid structure. Use joint filler with depth of 1/2 inch less than paving depth and press firmly against adjacent concrete.

H. Form intermediate joints between sections, with two thicknesses of bituminous paper cut neatly to paving cross section.

3.6 ROCK BASIN

A. Construct generally in accordance with rock energy dissipator requirements to indicated shape and depth. Rock courses may be placed in several operations but minimum depth of initial course must be 3 feet or greater.

3.7 ROCK BARRIER

A. Determine length required for ditch or depression slope and excavate compact and foundation area to firm, even surface.

B. Produce an even distribution of rock pieces, with minimum voids to the indicated shape, height and slope.

C. Construct coarse aggregate filter blanket against upstream face of rock barrier to the indicated thickness.

3.8 SEDIMENTATION POND

A. Clear and grub storage area and embankment foundation area site as specified in Section 31 00 00.

B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

C. Install pipe spillway, with anti-seep collar attached, at location indicated.

D. Place forms and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 31 00 00. Construction of embankment and trench prior to placing pipe is not required.

E. Mix, place, finish, and cure concrete, as specified in Section 32 16 10.

F. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

G. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 31 00 00. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 00 00

H. On entire sedimentation pond area, apply soil supplements and sow seed as per BMP notes in Plans Sheet C-101.

I. Mulch seeded areas with hay as per BMP notes in Plans Sheet C-101.

3.9 SEDIMENT TRAPS

A. Clear site, as specified in Section 31 00 00.

B. Construct trap by excavating and forming embankments as specified in Section 31 00 00.

C. Place coarse aggregate or rock at outlet as indicated on Drawings.

D. Place geotextile fabric, as specified for rock energy dissipater.

E. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 00 00.

F. On entire sediment trap area, apply soil supplements and sow seed as per BMP notes in Plans Sheet C-101.

G. Mulch seeded areas with hay as per BMP notes in Plans Sheet C-101.

3.10 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with BMP notes in Plans Sheet C-101 at 90 percent of permanent application rate with no topsoil.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with BMP notes in Plans Sheet C-101 permanent seeding specifications.

D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.11 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

B. Sediment should be removed from behind silt fence once it has accumulated to one-half the original height of the barrier. Fabric should be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months).

C. Hay bales shall be replaced every 6 months regardless of condition.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Do not damage structure or device during cleaning operations.

F. Do not permit sediment to erode into construction or site areas or natural waterways.

G. Clean channels when depth of sediment reaches approximately one half channel depth.

END OF SECTION

SECTION 31 3116

TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Soil Treatment: By the square yard of treated soil. Includes applying toxicant to designated soil, re-treating when directed, warranty, annual inspections.

1.03 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Instructions: Indicate caution requirement.

E. Record and document moisture content of soil before application.

F. Maintenance Data: Indicate re-treatment schedule.

G. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Alabama.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   2. Inspect annually and report in writing to Owner. Provide inspection service for one (1) year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.

B. Manufacturers:
   1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management.
   2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.
   3. Syngenta Professional Products: www.syngentaprofessionalproducts.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.
   3. Soil Within 10 feet of Building Perimeter For a Depth of 2 feet.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 32 0505

MINOR DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolishing designated building equipment and fixtures.
2. Demolishing designated construction.
3. Cutting and alterations for completion of the Work.
4. Removing designated items for Owner's retention.
5. Protecting items designated to remain.
6. Removing demolished materials.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplementary Conditions, Special Conditions, Technical Specifications, and General Requirements.

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Basis of Measurement: Lump Sum.

B. Basis of Payment: Includes all labor, materials and equipment associated with the minor demolition and removal of debris from the site as indicated on the Plans.

1.3 SUBMITTALS

A. City of Gadsden Division 105 - General Conditions

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:
1. Indicate demolition and removal sequence.
2. Indicate location of items designated for Owner's retention.
3. Indicate location and construction of temporary work.

1.4 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.5 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

1.6 SCHEDULING

A. Schedule Work to coincide with new construction.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation.

C. Coordinate utility service interruptions with Owner.
1. Do not disable or disrupt building existing utility systems without two days prior written notice to Owner.
2. Schedule tie-ins to existing systems to minimize disruption.

1.7 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public.

3.2 SALVAGE REQUIREMENTS

A. Coordinate with Owner to identify items and equipment required to be removed and delivered to Owner.

B. Tag components and equipment Owner designates for salvage.

C. Protect designated salvage items from demolition operations until items can be removed.

D. Carefully remove items and equipment indicated to be salvaged.

E. Disassemble as required to permit removal.

F. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Do not close or obstruct roadways or walkways without permits.

C. Cease operations immediately when structure appears to be in danger and notify Engineer.

D. Disconnect and remove designated utilities within demolition areas.

E. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

F. Demolish in orderly and careful manner. Protect existing facilities.

G. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

I. Remove temporary Work.

END OF SECTION

SECTION 32 1123

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Materials Source: Submit name of materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Crushed Aggregate Base: As specified in Alabama Department of Transportation, Standard Specifications for Highway Construction, Latest Edition, Section 301-A and Section 825.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify subbase has been inspected, proof-rolled, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Spread aggregate over prepared substrate to the total compacted thickness as shown or indicated in the Drawings.

B. Place aggregate in maximum 6 inch layers and compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. City of Gadsden Division 105- General Conditions

B. Maximum Variation from Flat Surface: 1/4 inch measured with 10 foot straight edge.

C. Maximum Variation from Thickness: 1/2 inch.

D. Maximum Variation from Elevation: 0.05 feet.

3.5 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Compaction testing will be performed in accordance with ASTM D1556.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests:
   1. Road: 1 test per 300 linear feet per lift.
   2. Parking Area: 1 test per 1,500 square feet per lift.

3.6 SCHEDULES

A. Under Asphalt Pavement:
   1. Compact placed aggregate materials uniformly to achieve minimum 98 percent of maximum density.

B. Under Concrete Pavement:
   1. Compact placed aggregate materials uniformly to achieve minimum 98 percent of maximum density.

END OF SECTION

SECTION 32 1216

FLEXIBLE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphaltic concrete paving, wearing, binder and base course.
2. Surface sealer.
3. Aggregate subbase course.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.

B. ASTM International:
1. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
2. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

1.3 PERFORMANCE REQUIREMENTS

A. Paving: Designed for streets, drives and parking areas.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit product information and mix design.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Alabama Department of Transportation standard.

B. Mixing Plant: Conform to Alabama Department of Transportation Standard.

C. Obtain materials from same source throughout.

D. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. City of Gadsden Division 105- General Conditions

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place bitumen mixture when temperature is not more than 15 degrees F below temperature at when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

A. Binder Course: In accordance with Section 424-B “Superpave Bituminous Concrete Binder Layer, 3/4 inch maximum aggregate size mix, ESAL range A/B” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

B. Wearing Surface Layer: In accordance with Section 424-A “Superpave Bituminous Concrete Wearing Surface Layer, 1/2 inch maximum aggregate size mix, ESAL range A/B” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

C. Tack Coat: In accordance with Section 405 “Tack Coat” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

2.2 SOURCE QUALITY CONTROL AND TESTS

A. City of Gadsden Division 105- General Conditions

B. Submit proposed mix design for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify compacted subbase is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify drainage facilities, manhole frames, water valves, and other utility structures are installed in correct position and elevation.

3.2 PREPARATION - PRIMER

A. Apply primer in accordance with ALDOT specifications.

B. Use clean sand to blot excess primer.

3.3 PREPARATION - TACK COAT

A. Apply tack coat in accordance ALDOT specifications.

B. Apply tack coat on asphalt and concrete surfaces over subgrade surface at uniform rate.

C. Apply tack coat to contact surfaces of curbs, gutters and concrete driveway turnouts.

D. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT

A. Place asphalt binder course within 12 hours of applying primer or tack coat.

B. Place binder course to thickness identified in schedule at end of section.

C. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

D. Place wearing course to thickness identified in Drawings.

E. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.5 CURBS

A. Install extruded asphalt curbs as indicated on Drawings.

3.6 TOLERANCES

A. City of Gadsden Division 105- General Conditions

B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from Indicated Elevation: Within 1/2 inch.

3.7 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Take samples and perform tests in accordance with ASTM D1556.

C. Frequency of Tests:
   1. Road: 1 test per 300 linear feet.
   2. Parking Area: 1 test per 1,500 square feet.

3.8 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect pavement from mechanical injury for 4 hours or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 1600

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Cast-in-place concrete.
2. Formwork.
3. Reinforcing.
4. Mix Design.
5. Control, expansion and contraction joint devices.
6. Placement procedures.
7. Finishes.
8. Testing requirements.

B. Related Documents:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Cast-in-Place Structures:
1. Basis of Measurement: Cubic Yard or Lump Sum.
2. Basis of Payment: Includes all labor, material, and equipment required to construct the concrete structures shown on the Plans and/or reflected in the Bid Form. Includes placing and compacting of base material, formwork, underground piping, drains, conduit, reinforcement, pouring and finishing of concrete, removal of forms, water stops, water proofing, expansion and control joints, cleanup and all related items.

B. Concrete Driveway Replacement:
1. Basis of Measurement: Square Yard or Cubic Yard.
2. Basis of Payment: Includes all labor, materials, and equipment required to place concrete surface at the thickness and cured strength shown in the Plans and/or reflected in the Bid Form. Includes saw cutting and removal of existing surface, backfill materials per the Plans, wire mesh, pouring and finishing concrete drive, cleanup and all related work. Also, shall include coordination with any residents to provide an alternate entrance to their driveway while concrete is curing. The maximum width for payment shall be as noted on the Plans.

C. Minor Concrete Structures:
1. Basis of Measurement: Cubic Yard.
2. Basis of Payment: Includes all labor, material, and equipment required to replace or construct any minor or miscellaneous structures as indicated in the Plans, directed by the Engineer, and/or reflected in the Bid Form. Items could include curb and gutters, sidewalks, and small slabs.

1.3 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 305 - Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
4. ASTM C150 - Standard Specification for Portland Cement.
5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
6. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
8. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
10. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
12. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
14. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type.
15. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
16. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
17. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
18. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

C. Design Data:
1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:

a. Hot and cold weather concrete work.
b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.

D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY CONTROL / QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cement and aggregate from one source for Work.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. Concrete Testing Service: Contractor shall employ a certified material testing laboratory to provide quality assurance testing during construction. Contractor is responsible to provide suitable quality control of materials, procedures, and of the mix design process to ensure the concrete conforms to the project plans and specifications. Submit quality control plan and proposed concrete mix designs to Engineer prior to concrete placement.

1.7 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 **FORM MATERIALS**

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
1. Use overlaid plywood complying with U.S. Product Standard PS-1 “A-C or B-B High Density Overlaid Concrete Form”, Class 1.

2. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class 1, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for a tight fit.

C. Form Coatings: Provide commercial formulation form coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A185 welded steel wire fabric.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar type supports complying with CRSI specifications.

1. For slabs-on-grade use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, class 1) or stainless steel protected (CRSI, class 2).
3. For sand blasted or intentionally roughened concrete surfaces, provide supports of stainless steel (CRSI, class 2).

D. Reinforcing Bars to be Welded: ASTM A706, “Specifications for Low Alloy Steel Deformed Bars for Concrete Reinforcement”.

E. Bar and Rod Mats: ASTM A184 “Specifications for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement”.

F. Threaded Dowels: Continuous Threaded high-strength steel bars. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the Drawings.

G. Mechanical Splices: Equal to “Cadweld Rebar Splices”, as manufactured by Erico Products, Inc., “C” Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on Drawings.

H. Steel Shapes, Plates and Rods: Conform to ASTM A36 “Specifications for Structural Steel”.

I. Do not weld reinforcing steel unless specifically noted on Drawings. If welding is shown, conform to latest revision of AWS D12.1, “Reinforcing Steel Welding Code of the

American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 **CONCRETE MATERIALS**

A. Cement: ASTM C150, Type I – Normal, Portland type for all applications other than structures used in conjunction with wastewater projects. All wastewater related structures shall use Type V – Sulfate Resistant, Portland Cement.

B. Fly Ash: ASTM C618, Type C or Type F.
1. Limit use of fly ash to not exceed 20 percent of cement content by weight.

C. Normal Weight Aggregate: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.
1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

D. Water: Clean, potable.

E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

G. Water Reducing Admixtures: ASTM C494, Type A.

H. High Range Water Reducing Admixtures (Super Plasticizer): ASTM C494, Type F or Type G.

I. Water Reducing, Non-Chloride Accelerating Admixture: ASTM C494, Type E.

J. Water Reducing, Retarding Admixture: ASTM C494, Type D.

K. All admixtures shall be supplied by the same manufacturer.

2.4 **ACCESSORIES**

A. Vapor Retarder: ASTM E1745 Class A; 6 mil thick fabric-reinforced plastic film, 0.03 perms; rated for below grade application. Furnish joint tape recommended by manufacturer.

B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

C. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 ksi; toughness 15 ksi; 3/4 inch long fibers, 34 million/lb fiber count.

D. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as shown on the Drawings.

E. Granular Base: Evenly graded mixture of fine and course aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

F. Sand Cushion: Clean, manufactured or natural sand.

G. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as abrasive aggregate for nonslip finish. Material shall be factory graded, rustproof, non- glazing, and is unaffected by freezing, moisture, and cleaning materials.

H. Colored Wear Resistant Finish: Packaged, dry, combination of materials consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides, interground with cement. Color as selected by Engineer.

I. Bonding Compound: Polyvinyl acetate or acrylic base.

J. Epoxy Adhesive: ASTM C881, two-component material suitable on dry or damp surfaces. Provide material type, grade and class to suit project requirements.

2.5 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, thickness as indicated on the drawings; tongue and groove profile.

B. Joint Filler Type B: ASTM D1751; cellular bonded fiber material, non-extruding, resiliency recovery of 70 percent if not compressed more than 50 percent of original thickness.

C. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, flush mounted.

E. Joint Sealant: ASTM C920, Type S; single component, self leveling, premium grade polyurethane sealant, equal to Sikaflex-1C SL.

2.6 CONCRETE MIX

A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.

C. Provide concrete to the following criteria:

Unit	Measurement
Compressive Strength (f'c at 28 day)	As Indicated in Plans
Aggregate Size (maximum)	1 inch
Air Entrainment	4 to 6 percent
Slump	3 to 5 inches

D. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 318-89 Section 5.3.

E. Mix design based on historical performances in accordance with ACI 318-89 Section 5.3, may be provided by a qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.

F. All concrete mix designs shall include the following information:

1. Proportions of cement, fine and course aggregates and water.
2. Water/cement ratio, design strength, slump and air content.
3. Type and source of cement and aggregates.
4. Type and dosage of all admixtures.
5. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.

G. Engineer to review and approve mix designs prior to start of concrete production.

H. Design mixes to provide normal weight concrete.

I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer.

J. All mix design information and data shall not be older than 18 months from the date of the submittal.

2.7 **ADMIXTURES**

A. Use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete as required for placement and workability.

B. Use high range water reducing admixture in pumped concrete, concrete required to be watertight, and concrete with water/cement ratio below 0.50.

C. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.

D. Use air-entraining admixture in concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete having an air content of 4% to 6% at the point of placement.

E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

F. Temperature Limit: Do not place concrete if the concrete temperature exceeds 90ºF or the ambient temperature is 40ºF or less and falling.

G. Slump Limit: Proportion and design mixes to result in concrete slump of 3 to 5 inches at point of placement.

2.8 **CONCRETE MIXING**

A. Provide batch ticket for each batch used on the project. Batch ticket must indicate project name, contractor's name, date, mix type, mix time, batch time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as specified.
1. Addition of water to batch for material with insufficient slump will be permitted in accordance with ACI 301.
2. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes. When air temperature exceeds 90 degrees F. reduce mixing and delivery time to 60 minutes.
3. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.

PART 3 EXECUTION

3.1 EXAMINATION

C. Submittals: City of Gadsden Division 105- General Conditions

A. Verify requirements for concrete cover over reinforcement.

B. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

1.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads.

B. Maintain formwork construction tolerances complying with ACI 301 Table 4.3.1.

C. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, bulkheads, anchorages, and other features required in work.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.

F. Chamfer exposed edges and corners as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

1.3 VAPOR BARRIER

A. General: Following leveling and tamping of granular base for slabs-on-grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.

C. After placement of vapor barrier, cover with sand cushion and compact to depth as shown on Drawings.

1.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

1.5 JOINTS

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls, slabs, beams and between walls and footings.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

G. Contraction (Control) Joints in Slabs-On-Grade: Construct contraction joints in slabs-on- ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth or approved inserts, unless otherwise indicated. Make saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregates.

1. With prior approval from Engineer contraction joints may be formed by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Refer to drawings for scoring pattern as shown. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible.

1.6 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with an approved, noresidual, low-VOC, form-coating compound before reinforcement is placed. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

1.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches 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.

E. Consolidate full depth of 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.

F. 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 time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. 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 derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations
   3. Maintain reinforcing in proper position during concrete placement.

H. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When placing concrete in cold weather, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.
   3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

I. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). 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.
3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Engineer.

1.8 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched. Fins and other projections exceeding 1/4 inch in height shall be rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaced, which have received smooth form finish treatment, not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.

1. Combine one part Portland dement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amount determined by trial patches, so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture

matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

F. Unless otherwise noted on the Drawings, all exposed surfaces shall receive a smooth rubbed finish.

1.9 SLAB FINISHES

A. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushed, brooms, or rakes, as required.

B. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessibly to power units. Check and level surface plane to tolerances of Ff 18-Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Being final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20-Fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.

D. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

E. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

F. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

G. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose nonslip aggregate.

1.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. 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.

C. Curing Methods: Perform curing of concrete by curing and sealing compound, b moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

D. Provide moisture curing by following methods.

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

1.11 REMOVAL OF FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until approved by the structural engineer.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

1.12 CONCRETE SURFACE REPAIRS

A. General: No surface shall be patched or repaired until the Engineer had reviewed the defective condition and approved the Contractor's submitted repair and/or patching materials and procedures.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.

1. Cut of honeycomb, rock pockets, and voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of

less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.

1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 in wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, when acceptable to Engineer by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method when acceptable to Engineer. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2

parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

F. Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

1.13 FIELD QUALITY ASSURANCE, CONTROL AND TESTING DURING CONSTRUCTION

A. General: The Owner may employ the Engineer or another professional firm to perform quality assurance testing during construction. The Contractor will notify the Engineer at least 24 hours prior to requiring tests. The Contractor is responsible to provide equipment to allow sampling and testing of the concrete at the point of placement.

B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Perform the following tests.

1. Slump: ASTM C 143; one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
2. Air Content: ASTM C 173 (volumetric method for lightweight or normal weight concrete) or ASTM C 231 (pressure method for normal weight concrete); one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
3. Concrete Temperature: ASTM C 1064; test hourly when air temperature is 40ºF and below or 80ºF and above, and each time a set of compression test specimens is made.
4. Compression Test Specimen: ASTM C 31; one set of 4 cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
5. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards or fraction thereof for each concrete class placed in any one day. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing, if required.
6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

C. Test results will be reported in writing to Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete supplier and testing agency, concrete type and class, location of concrete placed in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but **shall not** be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been

attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

F. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be provided by the Owner for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.

G. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

1.14 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 32 1610

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704/A704M, ASTM A615/A615M, Grade 60; steel bars or rods, unfinished.

C. Stirrups Steel: ASTM A82, unfinished.

D. Welded Steel Wire Fabric: ASTM A497 Deformed Type; in flat sheets or coiled rolls; galvanized finish.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcement as follows:

Item	Coverage
Concrete in contact with soil	3 inches
Exterior concrete	
Bars larger than No. 5	2 inches
No. 5 bars and smaller	1-1/2 inches
Interior concrete	
Bars larger than No. 11	1-1/2 inches
No. 11 bars and smaller	3/4 inch
Stirrups	1-1/2 inches

E. Conform to applicable code for all other conditions.

F. Splice reinforcing in accordance with splicing device manufacturer’s instructions.

G. Lap length shall be as follows unless otherwise noted on the Drawings:

Bar Size	Lap Length
No. 3	12 inches
No. 4	12 inches
No. 5	15 inches
No. 6	18 inches
No. 7	24 inches
No. 8	30 inches

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements; Section 01 70 00 - Execution Requirements.

END OF SECTION

SECTION 32 8400

LANDSCAPE IRRIGATION

1-01 SCOPE OF WORK:

A. Furnish all labor, materials and equipment for the proper design and installation of an irrigation system to service the landscaped areas. The system is to installed by a qualified licensed Irrigation Contractor.

1-02 SUMMARY OF WORK:

A. Extent of underground irrigation system is to be shown on the Drawings and in Schedules.

B. Provide all documents, labor, materials and equipment required by or inferred from the Drawings and Specifications to complete the Work of this section.

C. Provide additional work and materials required by local authorities at no extra cost to Owner.

1-03 QUALITY ASSURANCE:

A. Industry Reference Standards: Refer to Division 1 Reference Standards Section.

1. American Society for Testing and Materials (ASTM).
   D 3139-89 Specification for Joints for Plastic Pressure Piping Using Flexible Elastomeric Seals.
2. National Electric Code (NEC), 1990 Edition.

B. Qualifications:

1. Installer Qualifications: Engage a company specializing in irrigation installation. Installer shall have successfully completed five projects similar in scope and size, as indicated in
   a. Firm Experience Period: Five years of experience.
   b. Field Foreman Experience: Five years of experience with installing firm.

2. Codes and Standards: Perform Irrigation Work in compliance with applicable requirements of governing authorities having jurisdiction. County regulations supersede these specifications. Notify Landscape Architect in writing of all discrepancies immediately.

3. Do not make substitutions: If the Contractor desires to make substitutions of materials, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials. Submit this request and information to Landscape Architect.

4. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Owner and Landscape Architect. They have the right to reject any and all materials and any and all Work which, in their opinion, does not meet the requirements of the Contract Documents at any stage of the operations. Remove rejected Work and or materials from Project Site and replace promptly.

5. Workmanship: Install materials and equipment in a neat and professional manner following manufacturer's recommendations.

6. Professional Irrigation Consultant shall be:

    a. A professional firm whose primary source of income is derived from the professional irrigation design services they offer to the clients they represent.
    b. A professional consulting firm without any affiliation to contractors, product suppliers, manufacturers or any interest that could be construed as a conflict of interest to the proposed project.
    c. A professional firm that has experience in the design and administration of projects of similar scope and size as described in the Scope section.
    d. Is a professional firm covered by all the necessary insurance's including general liability, and Error's & Omissions coverage. (provide proof of insurance documentation)

1-04 SUBMITTALS:

A. Approval: Obtain approval from Landscape Architect for all submittals prior to the beginning of Work, unless otherwise approved.

B. Drawings shall be clearly and neatly plotted on a mylar sepia, and submitted along with three (3) sets of blue lines for review and comment by representatives of the Owner. All automatic and manual valves, quick couplers, sprinklers and ancillary equipment shall be shown at scale to determine actual field dimensions.

C. Construction Documents submittals must be approved by an Owners representatives prior to an official notice to proceed

D. As-Built Drawings: Any changes in the layout and/or arrangements of the proposed irrigation system, or any other differences between the proposed system and actual installed conditions are to be recorded by the Irrigation Contractor in the form of an "As-Built" Drawing. As-Built Drawing to be clearly and neatly drawn on a mylar sepia base of the original design provided by the Landscape Architect. Provide Owner and Landscape Architect with a reproducible mylar copy of the As-Built Drawings. Provide the Owner and the Landscape Architect with a copy of the As-Built Drawings before Work under this Contract will be considered for Acceptance. All automatic and manual valves, quick couplers, and wire splice locations shall be shown with actual dimensions to permanent bench mark points so they may be located easily in the field. Submittals of approved As-Built Drawings will precede any Application for Final Payment by the Contractor.

E. Product Data: Submit 6 sets, for information only, manufacturer's specifications, product data, installation instructions and general recommendations for **all components** of the irrigation system. Each submittal is to clearly identify the product, series/model number by use of a high lighter.

F. Installer Certification: Submit written documentation certifying that Irrigation Contractor and Irrigation Consultant complies with requirements of "Installer Qualifications" above.

1-05 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials and equipment in such a manner as to not damage the parts or decrease the useful life of equipment.

B. Store materials away from detrimental elements. Coordinate with General Contractor to secure a safe staging area.

C. Handle, load, unload, stack and transport materials for irrigation system carefully to avoid damage. Handle pipe in accordance with manufacturer's recommendations.

1-06 PROJECT CONDITIONS:

A. The site irrigation system is comprised of ***two major components***, an irrigation distribution and sprinkler system. The Contractor shall connect the distribution network to the ***irrigation point of connection***. The Contractor will reimburse the Owner for all work deleted and not completed.

B. The Irrigation System is designed to operate under the following conditions: Street Level: a minimum of 45 **psi** water pressure, and at least 50 **gpm** available water supply/Upper Levels: a minimum of 45 psi water pressure and at least 25 gpm available water supply.

C. Insurance on irrigation materials or equipment stored or installed is the responsibility of the Irrigation Contractor. Such insurance shall cover fire, theft and vandalism. Should the Contractor elect not to provide for such insurance, he will in no way hold the Owner responsible for any losses incurred by the aforementioned acts. The Irrigation Contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to Substantial Completion of the Work.

D. Obtain all required permits and pay all required fees, at no additional cost to the Owner. Any penalties imposed due to failure to obtain permits or pay fees are the responsibility of the Contractor.

E. Provide and maintain all passageways, guard fences, warning lights and other protection devices required by the local authorities.

F. Existing Grades: Existing grades will be within .2 feet of grades shown on the Civil Engineering Drawings at time of irrigation work. Determine condition of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Perform Work in a manner which will avoid damage to finished grading and drainage resulting from the work covered in these Contract Documents shall be repaired at the Contractor's expense.

G. Existing Site Improvements: Perform Work in a manner which will avoid possible damage. The Contractor is responsible for any damage of mechanical nature as well as damage resulting from leaks in the irrigation system whether due to negligence or otherwise.

H. Test water conditions: The Contractor shall check the pressure at the ***irrigation point of connection*** and confirm minimum operating pressure noted in this Specification. If minimum operating pressure cannot be obtained, notify Landscape Architect.

1. In the event the water pressure does not meet minimum operating pressure at the irrigation point of connections noted in this Specification, notify Landscape Architect. The Irrigation Consultant will make recommendations concerning the development of a booster pump station capable of providing the flow and pressure required as indicated in the Specifications Section 1-06, Paragraph B.

2. In the event the water pressure significantly exceeds the operating pressure noted in this Specification, provide a pressure regulator down stream of the backflow preventer.

I. Sleeves, if required, are to be installed by the General Contractor. Irrigation sleeves shall be installed as per details. If sleeving horizontal depth exceeds the detailed requirement by 6 inches (6"), it will be the responsibility of the General Contractor to expose the horizontal ends below finish grade. The General Contractor is to expose irrigation sleeves for Irrigation Contractor prior to start of Irrigation Work in all

areas where sleeving is not installed as per details. Coordination and scheduling for excavation of sleeve ends is the responsibility of the Irrigation Contractor.

J. Coordinate and schedule all Work with General Contractor.

K. Damages resulting from irrigation installation to work of other trades must be repaired at the expense of the Irrigation Contractor in a timely fashion.

L. Make minor adjustments to system layout as may be required and requested at no additional cost to the Owner.

M. Keep Project Site clean and orderly at all times during construction

1-07 WARRANTY:

A. Warranty all Work for a period of one year, starting on the Date of Substantial Completion, against defects in materials, equipment, workmanship and any repairs required resulting from leaks or other defects of workmanship, material or equipment.

B. Repair unsatisfactory conditions promptly at no cost to the Owner.

C. Emergency repairs may be made by the Owner without relieving the Irrigation Contractor of his warranty obligations.

D. Repair settling of backfilled trenches occurring during the warranty period, including restoration of damaged plantings, paving or improvements resulting from settling of trenches or repair operations.

E. Respond to Owner's request for repair work within ten (10) days. If not, Owner may proceed with such necessary repairs at the Contractor's expense.

PART 2 - PRODUCTS

2-01 PIPE AND FITTINGS

A. All Plastic Pipe from sizes 3" and above shall be Class 200, SDR 21, unplasticized rigid PVC pipe with integral bell and rubber ring gasket unless otherwise specified. Pipe from sizes 2 1/2 to 1 1/4 shall be Class 200, solvent weld P.V.C. pipe or HDPE DR 11. Pipe from sizes 1" and 3/4" shall be Class 200, solvent weld P.V.C. pipe or HDPE DR 11. 1/2" pipe shall be Class 315 solvent weld P.V.C. Pipe or HDPE DR 11. All pipe shall be supplied in 20' standard lengths. All pipe that is exposed or not below grade shall be Schedule 80 PVC. All pipe shall be in color.

B. Fittings for integral bell rubber ring gasketed pipe (3” & larger), shall have the gasket type fittings.

C. All pipe fittings size 3" and greater shall be ductile iron in construction. All fittings 2 1/2" and under shall be Schedule 40 solvent weld fittings rated for 200 psi (ASTM D-3139) or HDPE fittings.

D. Solvent weld PVC pipe, shall be rigid PVC pipe and shall be assembled using appropriate PVC pipe cleaner/primer and solvent cement in accordance with the manufacturer's recommendations. Solvent cement shall be # 715 Gray NSF approved.

E. All solvent weld fittings shall conform to Schedule 40 or Schedule 80 PVC dimensions and specifications for solvent weld fittings.

F. Expansion Joints: Shall consist of integral bell and rubber gasket coupling, install every 300 feet of solvent weld piping.

G. Runs of pipe over 20' length must be installed with standard 20' length sections..

H. PVC Pipe Couplings Located Within Sleeves: 4" and smaller to be solvent weld. 6" and larger to be mechanical joints. Upon existing sleeves, pipe solvent weld or integral bell and rubber gasket, as specified.

2-02 RISERS

A. Provide Threaded Schedule 80 PVC Risers. All risers above grade to be either dark gray or black PVC pipe.

2-03 ELECTRIC WIRING

A. 120 Volt AC Wiring: 120 volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service to be provided by ***Contractor.***

B. Splices in controller wiring shall be waterproof.

1. Acceptable Manufacturers and Products:
   a. Manufacturer: 3M
      (1) Product: DBY
   b. Manufacturer: 3M
      (1) Product: 3577
   c. Manufacturer: Paige
      (1) Product: DBY

C. Control Wiring shall be 600 volt solid wire U.L. approved for direct burial in ground. Minimum wire size: 14 gauge. Control wiring and wiring connections from the controller to the valves is included in this Contract.

1. Acceptable Manufacturers and Products:
   a. Manufacturer: Paige Electric Co.
   b. Manufacturer: King Wire and Cable
   c. Manufacturer: Spectrum Wire Corporation

2-04 SPRINKLER HEADS

A. Spray and rotary sprinklers: Provide where indicated on the drawings. All spray heads (6” & 12” pop up) shall be installed on RainBird or equal swing tubing pipe and Sch. 40 barbed street ells. Heads, drip tubing, and emitters shall perform to Manufacturer's Specifications concerning diameter of throw and gallonage at provided pressure.

1. Acceptable Manufacturers and Products:
   a. Manufacturer: Rainbird
      (1) Product: Sprays # 1806 and # 1812
      (2) Product: Rotor # 5000

   b. Manufacturer: Hunter
      (1) Product: Sprays # PROS-06 and # PROS-12
      (2) Product: Rotor PGP

B. Drip Irrigation Emitters shall be of the in-line self cleaning, pressure compensating or insertable variety where indicated on drawings.

1. Acceptable Manufacturers :
   a. Manufacturer: Netafim Irrigation Inc.

2-05 AUTOMATIC CONTROLLER

A. Each controller location must be easily accessible for maintenance. Provide for the possibility of making minor timing adjustments to the controller in the field.

B. Provide controllers capable of fully automatic, as well as manual operation of the system. Controller housing is to be a wall or pedestal mounted, where noted on the drawings, in weatherproof, lockable cabinet.

C. Provide controller which operates on a minimum of 110 volts AC power input and is capable of operating 24 vole AC electric remote control valves, with a reset circuit breaker to protect from overload. Contractor is responsible for connection to 120 VAC power to controller.

D. Each station shall have a time setting which can be set for variable timing in increments from 0 to 60 minutes minimum, or set to omit the station from the irrigation cycle.

E. The controller shall have a master "on-off" switch shall allow the valve power output to be interrupted without affecting the controller.

F. The controller shall be constructed so that all internal parts are accessible through the controller door without disturbing the cabinet installation.

G. Acceptable Manufacturers and Products:

1. Manufacturer: Rainbird – Ref Plans

2-06 METER

A Owner to provide domestic irrigation water meter as indicated on drawings and which will comply with Manufacturer's Specifications and applicable local codes. Irrigation shall plan and provide potable water supply as permanent water source. Point of connection as shown on plans.

2-07 BACKFLOW PREVENTER:

A. The Contractor shall provide a backflow device at the domestic irrigation water meter. The backflow preventer shall be a reduced pressure assembly type, capable of having a flow rate of ***50*** gallons per minute (GPM) with a pressure loss not to exceed ***7.5*** pounds per square inch (PSI) and shall be suitable for supply pressure up to 150 PSI. The backflow preventer body to be bronze, internal parts stainless steel, and the check valve assemblies tight seating rubber. The backflow preventer assembly must include two gate valves for isolating unit, and two ball valve test cocks for testing unit to insure proper operations. All backflow devices should conform to all local codes and regulations. Verify and coordinate with water system requirements.

2-08 VALVE BOXES

A. Control Valves: Shall be in a 10” Round Valve Box with non-hinged cover.

B. Backflow Preventer: Shall be in a 20" x 34" Valve Box with non hinged cover.
C. Isolation Valves and Wire Splices and Quick Coupling Valves: Shall be in a 10" round valve box with cover.
E. Acceptable Manufacturers:

1. Manufacturer: Carson/ Brooks
2. Manufacturer: Ametek
3. Manufacturer: DFW / HPI

2-09 SLEEVES

A. Sch. 40 PVC

2-10 QUICK COUPLING VALVES AND KEYS

A. Quick coupling valves shall all have purple tops and be used as a source to the pressurized main line so that a hose can be attached for manual hand watering. The quick coupling valve will be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve. The valve will also have a hinged locking purple rubber cover to prevent any debris getting into the internal mechanism of the valve. The cover shall be marked with "Do Not Drink" in English and Spanish. All quick coupling valves will be installed on a triple elbow swing joint. Provide size as indicated on drawings.

B. Quick coupling keys shall be of the single lug variety. Attached to the key will be a hose swivel adapter sized to the commonly used hose on the project. The key and swivel will both be constructed of brass.

C. Acceptable Manufacturers:

1. Manufacturer: Rainbird
2. Manufacturer: Hunter

2-11 HOSE BIBS:

A. Provide all cast brass or bronze body hose bibb installed below grade in a 12" x 18" valve box.

B. Acceptable Manufacturers:

1. Manufacturer: Hammond
2. Manufacturer: Nibco
3. Manufacturer: Woodford

2-12 CONTROL VALVES:

A. Provide electric remote control valves (size as indicated on drawings). Valves are to be constructed of a glass-filled nylon material with a self cleaning stainless steel screen. Low flow/low pressure operating capabilities. Flow: .5 to 200 GPM; Pressure: 20 to 200 PSI. Valves to contain purple I.D. Christy Tags and conform to Manufacturer's Specifications concerning performance and at pressures provided.

B. Acceptable Manufacturers:

1. Manufacturer: Rainbird

2-13 SURGE PROTECTION EQUIPMENT

A. Provide lightning arrestor for controllers not equipped with primary surge protection.

2-14 ISOLATION VALVES

A. Provide all gate valves for isolation purposes, allowing full diameter opening when in full open position.

B. Manually operated valves: same size as line.

C. Valves 3" or smaller: brass construction, threaded, and rated for 200 psi WOG.

1. Acceptable Manufacturers:

a. Manufacturer: Pegler
b. Manufacturer: Nibco
c. Manufacturer: Hammond

2-15 MISCELLANEOUS SYSTEM COMPONENTS

A. Provide risers, reducers, couplings, adapters, fittings as necessary to complete the irrigation system.

B. Provide rain sensor with adjustable shut-off point from 1/8" to 1" of accumulated rainfall. Switch will interrupt common wire. Unit shall be UL approved.

1. Acceptable Manufacturers and Products:

a. Manufacturer: Rainbird
(1) Product: Raincheck

b.. Manufacturer: Hunter
(1) Product: Mini-clik

PART 3- EXECUTION

3-01 GENERAL

A. Inspection of Work in progress: During the installation, the Landscape Architect will make regular inspections and reject any work and materials which do not meet the requirements called for in the Contract Documents.

B. Inspect project site prior to start of Work to determine that all site conditions are acceptable for Irrigation Work to begin. Inform Landscape Architect of unsuitable conditions. Do not proceed with installation of irrigation system until unsatisfactory conditions have been corrected in a manner acceptable to installer.

C. Locate all existing underground utilities prior to trenching and/or boring operations. Obtain utility locations from Owner and/or General Contractor and utilize utility locating services when necessary.

3-02 EXCAVATION:

A. All excavation is unclassified and includes all materials encountered that are not classified as rock excavation.

B. Report exceptions to the Landscape Architect before excavation. An adjustment in price will be established which includes removal and disposal of the unsuitable material, and the acquiring of additional backfill material.

C. Excavation in newly sodded areas: Prior to excavation, remove sod, preserve and replace after backfilling is completed.

D. Excavation in established grass or newly seeded areas: After excavation and backfilling is completed, re-grade trenched area consistent with surrounding area and re-seed with 100% pure seed of type grass existing. Mulch with straw and water.

E. Excavation through existing asphalt, cutting, removal and replacement of asphalt, as noted on the drawing, is the responsibility of the Irrigation Contractor.

3-XX EXCAVATION:

A. All excavation shall be classified and shall include all materials encountered except materials which cannot be excavated by normal mechanical excavation means. For the purpose of these specifications "normal" mechanical means shall include the use of all power equipment normally employed in the construction of commercial irrigation systems including chain trenchers with small backhoe units and backhoes units equipped with buckets up to and including 24" wide. Equipment beyond this including blasting equipment, jack hammers, larger backhoes (than described above), backhoes type machines equipped with jack hammer units. or the like shall be considered as being beyond "normal" mechanical means.

B. Report exceptions to the Landscape Architect before excavation. An adjustment in price will be established which includes removal and disposal of the unsuitable material, and the acquiring of additional backfill material.

3-XX LEAKAGE TEST:

A. The system shall be subjected to a leakage test. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the design working pressure after all air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not exceed the quantity determined by the formula given below:

$$L = \frac{ND(\text{Square root of } P)}{3700}$$

Where **L** = allowable leakage in gallons per hour
N = number of joints in pipeline
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in psig

If leakage exceed the allowable rate, leaks shall be found and repaired and the test repeated until successful.

3-03 BACKFILL:

A. Backfill material shall be free from rocks, large stones, and other unsuitable substance which could damage the pipe or create unusual settling problems. Backfill in 6" layers and tamp after each layer to prevent excessive settling.

B. Backfill trenches containing plastic pipe when pipe is cool to avoid excessive contraction in cold water. Such backfilling can be done in early morning hours or the pipe may be water cooled prior to backfilling procedures.

C. Minimum depth of cover of all pipe is a follows:

1. 1/2" - 1" pipe - minimum depth cover is 12".
2. 1 1/4" - 2" pipe - minimum depth cover is 18".
3. 2 1/2" - 4" pipe - minimum depth cover is 24".

3-04 SLEEVING:

A. Location of sleeving shown on the drawings is schematic. General Contractor to make adjustments necessary to accommodate existing vegetation, utilities and other existing conditions.

B. Repair of damage to existing utilities, structures or other construction resulting from installation of sleeves is the responsibility of the General Contractor.

C. Irrigation sleeves shall be installed as per details. If sleeving horizontal depth exceeds the detailed requirement by (6") 6 inches, it will be the responsibility of the General Contractor to expose the horizontal ends below finish grade. In all areas where sleeving is not installed as per details the General Contractor is to expose irrigation sleeves for Irrigation Contractor prior to start of the Irrigation Work

3-05 PIPE:

A. Pipe Joints:

1. Solvent Weld PVC Pipe: Assemble according to Manufacturer's Recommendations, using appropriate PVC pipe cleaner/primer and solvent cement.

B. Main Line: Install according to Manufacturer's Recommendations. Provide concrete thrust blocks at all directional changes on all pipe 3" and larger that is of the gasketed variety, as per drawings.

C. Pipes and Fittings:

1. Install according to manufacturer's Recommendations including snaking-in of PVC pipe to prevent excessive strain when contracting in cold weather.

D. Lateral Lines and Risers:

1. Install according to Manufacturer's Recommendations using standard techniques.
2. Combine lateral lines and main supply lines in common trenches wherever possible.
3. .Install risers such that no excessive movement occurs while sprinkler head is in operation. Height of risers to be in accordance with planned and existing plant material. Height of all risers is subject approval of Landscape Architect.
4. Plug lines immediately upon installation to minimize infiltration of foreign matter.
5. Flush lateral lines and risers prior to installation of sprinkler heads.
6. Above ground risers must be dark gray or black in color.

3-06 SPRINKLER HEADS

A. Low Pop-up Sprinkler Heads: Install in such manner that top is 1" above finish grade. Where finish grade has not been established extend a riser minimum of 12" above existing grade to mark location of head. After finish grade is established install heads as shown on the drawings.

B. High Pop-Up Shrub Heads: Finish height to be determined by Landscape Architect.

C. Backfill around sprinkler head assembly in such manner as to stabilize the sprinkler head so that no lateral motion is exhibited during operation.

D. Sprinkler heads on risers: Install as shown on the drawings. High-pop sprinkler heads shall be installed in landscape areas to retract out of sight when non-operational. Height of all heads in bed areas to be determined in the field by the Landscape Architect.

E. Drip irrigation emitters are to be located in a manner that will provide optimum concentration of water to the plant material. Drip irrigation shall be installed in a grid pattern with manifolds to insure hydraulic balance.

3-07 ELECTRIC CONTROL WIRES

A. Install control wires in orderly fashion, locate in main line trench. Bundle wires together and tape at 5' intervals. Position wires to the right of the water supply line in the direction of the water flow.

B. Provide looped slack at directional changes in supply line to allow for contraction of wires.

C. Keep wire splices to a minimum and provide 10" round valve box at each splice location.

D. Pass wires under existing or future paving, construction, etc., through PVC sleeves.

E. For each open station on any given controller, there shall be spare wire to the furthest (2) two control valves located in diametricly opposed directions from the controller.

3-08 CONTROL EQUIPMENT:

A. Install automatic valves and controllers according to Manufacturer's Recommendations and as shown on the Drawings.

3-09 VALVE BOXES:

A. All valves are to be housed in valve boxes. Install according to Manufacturer's Recommendations, and as shown on the drawings. Position boxes at a height that will not cause them to interfere with maintenance machinery (e.g., movers) and such that soil and mulch do not wash into the box. Locate valve box in mulched or natural areas one foot inside the bed line. Where no mulched areas or natural areas exist within forty feet of valve box locations install valve box in turf area. Install no more than two valve boxes together when installed in turf areas.

3-10 SURGE PROTECTION EQUIPMENT:

A. Install surge protection equipment on primary (110 VAC) power lines in accordance with the electrical grounding instructions included with each controller. Connect each surge protection unit to at least one 5/8" diameter by 9' long copper clad grounding electrode driven into the soil to its full depth. Place electrodes no closer than two (2) feet from the controller cabinet or any control or power wire. Be consistent in locating ground rods throughout the installation with respect to controller positions.

B. Ground wire between surge protection device and grounding electrode to be single strand bare copper wire at least one size greater than the wire supplying power to the control unit. Route ground wire away from power and control wires where possible. When it is necessary to pass through the controller cabinet wall use two (2) #L-70 copper grounding lugs and a brass bolt as noted on the drawings. Use a #WE 5/8 ground rod clamp (single piece and bolt) to make connection between ground rod and ground wire. Bury ground wire passing between controller and ground rod a minimum of ten inches. Cover the top of the rod and the clamp itself with a 4" round cover with lid at grade level.

3-11 BALANCING AND ADJUSTMENT:

A. Balance and adjust the various components of the sprinkler system so that the overall operation of the system is most efficient. This includes synchronization of the controllers, adjustments to pressure regulators, part circle sprinkler heads, and individual station adjustments on the controllers.

B. Upon completion of the irrigation system, perform a coverage test with the Owner's representative to determine if the irrigation coverage is adequate. Correct any inadequacies.

3-12 IRRIGATION DISTRIBUTION AND SPRINKLER OPERATION TESTING:

A. Upon completion of the irrigation system, and after head installation, test the entire system for proper operation. Flush all air from the system and check components for proper operation.

3-13 OWNER ORIENTATION:

A. Upon completion of the Work and at a time and place acceptable to the Landscape Architect and Owner, the Irrigation Contractor is responsible for the orientation of the Owner's maintenance personnel in the operation, maintenance, and repair of the system. Furnish copies of all available parts lists, trouble shooting lists and specification sheets, to the Landscape Architect.

1. Operating and Maintenance Manuals shall constitute the basis of orientation.

B. Set the initial watering schedules and programming of the automatic controllers at direction of Landscape Contractor.

3-14 WINTERIZING THE SYSTEM:

A. The irrigation system shall be winterized the first winter season following Substantial Completion of the Project in total. The irrigation piping shall be winterized by first blowing the system clear of water using compressed air (80 psi maximum) admitted into the piping at a quick coupling valve or hose bib located at a higher elevation on the system piping. Activate individual zones, higher zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor must be sized to provide the volume requirements necessary to completely evacuate the irrigation piping system. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature air from being injected directly into the PVC piping.

3-15 CLEAN UP AND PROTECTION:

A. During irrigation Work, keep Project Site clean and orderly.

B. Upon completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to the satisfaction of the Landscape Architect.

C. Protect Irrigation Work and materials from damage due to irrigation operations, operations by other contractor and trades and trespassers. Maintain protection until Date of Substantial Completion.

D. Cover all openings in to the system as it is being installed to prevent obstructions in the pipe and the breakage, misuse or disfigurement of the equipment.

E. Theft: Irrigation Contractor is responsible for theft of equipment and material at the job site before, during and after installation, until Date of Substantial Completion of the Work in total.

3-16 INSPECTION AND ACCEPTANCE:

A. Periodic Inspections will be made by the Landscape Architect to review the quality and progress of the work. Work found to be unacceptable must be corrected within five calendar days. Remove rejected materials promptly from the project.

B. Upon completion of Work, the Contractor shall notify the Landscape Architect and Owner at least ten (10) days prior to requested date of inspection for Substantial Completion of all portions of the Work. Landscape Architect will issue a punch list for work to be corrected. All work on the punch list must be completed within five (5) working days form the date of inspection. Where inspected Irrigation Work does not comply with requirements, replace rejected Work. If such replacements are not completed within the time specified, the Irrigation Contractor may be considered to be in default of the Contract, and the Owner may use the Contract Retainage to hire other Contractors to finish the Work.

C. It will be the responsibility of the Irrigation Contractor to provide a reliable communication system (i.e.: Two way radios or remote radio control activation system) for Substantial Completion and all periodic inspections.

D. If an inspection to verify Substantial Completion has been scheduled and the Landscape Architect arrives at the site and determines that the Irrigation System is not substantially complete (all system components in place, operational and checked) the Contractor shall be responsible for all costs incurred by the Landscape Architect to inspect the site. Reimbursable expenses include but are not limited to the following: Mileage, airfare, consultants time, parking fee, meals, rental car, etc. All incurred expenses will be deducted from the final contract amount.

E. Certificate of Substantial Completion will be issued for acceptable work and completion of "As-Built" Drawings, the Landscape Architect will verify the system for Substantial Completion. If punch list items are issued with the Certificate, they must be corrected within five (5) working days.

END OF SECTION

SECTION 32 9113

TOPSOIL

Description

Landscape soil shall be used for soil preparation and amending soil for landscape areas, erosion control areas, and lawn areas. The terms landscape soil and topsoil can be used interchangeably for this specification.
Lawn areas are defined as any area that will support grass either planted as seed or sod including trees.
Landscape areas are defined as any area that will support perennials, annuals, bulbs, shrubs, and trees.

1.01 Quality Assurance

A. If the Drawings or Specifications disagree among them or the Drawings disagree with the Specifications, the greater quantity and better quality of work shall be bid upon and provided by the Contractor.

B. The submittals listed below will be made for the landscape soil aspect of this project to the Construction Manager.

1. Manufacturer's and/or source data for all materials including soils.
2. Certified chemical and mechanical analysis of samples of topsoil, existing soil, soil mixes, soil amendments and organic compost materials used in making of soil mixes.

3. Samples provided by the Contractor shall be typical of material to be delivered to the site and shall provide an accurate indication of color, texture, and the organic make-up of the material. Submit three pound samples of the following:

a. Organic Matter: one sample of each type of organic matter to be used.
b. Imported Off-Site Soil Prior to Amendment: one sample
c. Amended Off-Site Soil: one sample

5. Submit soil tests to the Construction Manager for all soil to be obtained from both on-site and off-site stockpiles.

D. Soil Testing

1. All soil testing shall be done at the Contractor’s expense. Soil tests shall be conducted by a state laboratory or recognized commercial laboratory. Each sample shall be extracted from a six-inch deep core and prepared in accordance with recommendations of the soil-testing laboratory.
2. Each soil test shall determine soil texture (mechanical analysis), pH, magnesium, phosphorus, potassium, soluble salts, total calcium, nitrogen, and percent organic matter. If the soil is sandy, it shall also be tested for boron. Soil test results shall include laboratory recommendations for soil amendments to correct deficiencies and accomplish planting objectives.
3. For all new soils provided from off-site sources, obtain one soil test for each soil source per 500 cubic yards of soil and submit soil test results and soil amendment recommendations to Construction Manager for review and acceptance prior to distributing and amending soil.
4. If available, for all existing stockpiled topsoil to be redistributed on site, obtain one soil test per 500 cubic yards of soil prior to application. Submit soil test results and soil amendment recommendations to Construction Manager for review and acceptance prior to redistributing and amending soil.
5. Where paving and base materials have been removed and the area is to be re-established with lawn or planting, obtain one composite soil test per 10,000 square feet of subsoil material, or at least one composite test for each separate excavated area. Each composite soil test shall consist of no less than

five one-half cup samples taken at random from each sampling area. Each sample shall be taken from a six-inch deep core. The five or more samples shall be mixed together to form a composite sample, from which a pint sample shall be extracted, air-dried and tested. Submit soil test results and subsoil amendment recommendations to Construction Manager for review and approval subsoil amendment recommendations prior to filling the area with soil.

6. Following completion of soil amendment operations retest and provide analysis for approval. These samples shall not be composite samples and are to assure that soils have been amended properly prior to planting or installation of lawn. If it is apparent that soils have not been amended as specified or protected from contamination, areas not in compliance with specified requirements shall be reworked and retested as required until soils meet specified requirements. All rework and retesting shall be at the Contractor's expense.

E. Delivery, Storage, and Handling

1. Package materials will be delivered in manufacturer's unopened container or bundles; they will be identified with name, brand, type, weight, and analysis. Packaged materials will be stored in a manner that will prevent damage or intrusion of foreign matter. Any material that becomes contaminated will be removed from the job site.
2. Organic amendments will not be delivered or installed excessively wet or frozen.
3. Delivery location, stockpile locations and schedule will be coordinated with the Construction Manager prior to delivery. Soils will be protected from eroding while stockpiled on site.
4. Bulk materials will be stabilized after delivery according to the Sediment Control Plan.

F. Job Conditions

1. The Contractor shall notify the Construction Manager at least ten (10) calendar days prior to the start of landscape soil installation.

2. Determine location of all underground utilities prior to soil work. Existing utilities, paving, vegetation, and other facilities will be protected from damage caused by soil installation operations. All damaged areas; facilities and materials shall be restored, repaired or replaced as directed by Construction Manager at the Contractor's expense.
3. Commencement of work constitutes acceptance of conditions under which work is to be performed. After such acceptance, Contractor will be responsible for correcting unsatisfactory and defective work resulting from unsatisfactory conditions.

1.02 Materials

A. Landscape Soils is amended soil from an off-site source that has been spread to finish grade, will support plant growth, and meets the following requirements. The soil shall closely match the mechanical analysis (percentage sand, silt and clay) of the existing subsoil. Soil shall be free of cinders, stones, slag, coarse fragments, gravel, sticks, trash, roots, and other debris over 3/4". Soil will be to a depth of 12" for landscape areas, 6" for lawn areas, and 18" for individual trees and shrubs. It must also be free of plants or plant parts of Bermuda grass, Quack grass, Johnson grass, Nutsedge, Poison Ivy, Phragmites, Canada thistle, or any noxious weeds. The soil shall contain no substances harmful to plant growth. If the existing native subsoil is a bank run gravel, the topsoil or landscape bedding soil shall be a sandy loam.

1. Soil for lawn areas:

a. The pH shall be between 6.0-7.0.

b. The acceptable amount of Magnesium shall be 35 pounds per acre; Phosphorus shall be 100 pounds per acre; Potassium shall be 85 pounds per acre, and Nitrogen shall be a minimum of 50 pounds per acre.

c. Soluble salts shall not exceed 3 mmhos/cm. Calcium levels shall not exceed 2000 parts per million.

d. Organic Matter shall be greater than three percent.

2. Soil for Landscaping areas

a. The pH shall be based on the specific plant requirements but will be within the range of 5.5-6.5.

b. The acceptable amount of Magnesium shall be 71-124 pounds per acre; Phosphorus shall be 62-102 pounds per acre; Potassium shall be 85-160 pounds per acre, and Nitrogen shall be a minimum of 50 pounds per acre.

c. Soluble salts shall not exceed 4mmhos/cm, Calcium levels shall not exceed 2,000 parts per million.

d. Organic Matter shall be greater than five percent.

3. The following soil amendments may be used to amend the soil to meet specified requirements. Soil amendments and rates of application are to be determined based on soil test results.

a. Sulfur: Sulfur for adjustment of soil pH shall be an unadulterated flower of sulfur.

b. Lime: Ground or pulverized limestone, which contains a maximum of 50 percent total oxides.

c. Organic Matter: To increase organic matter based on soil test results, the following materials can be used:

I. Yard Debris Compost: Compost made from yard trimmings, such as leaves, grass clippings and pruning that have been properly composted, are mature and have been sieved through a ¾ inch screen. Compost shall be free of trash and contain no toxic substances harmful to plant growth.

d.. Amendments

1. Fertilizer: Fertilizer analysis and rate of application shall be determined based on soil test results. Fertilizer shall be uniform in composition, free flowing and suitable for application with approved equipment. If compost is used to amend soil, fertilizer is usually not required.

2. Sand: Clean, washed, coarse masonry sand, sized up to ¼" particles.

3.. Diatomaceous Earth: Diatomite, Isolite, or approved equal.

1.03 Construction

A. Examination and Verification of Conditions

1. The areas and conditions where planting amendments are to be installed will be examined, and the Contractor will be notified of conditions detrimental to proper and timely completion of work. Work will not proceed until unsatisfactory conditions are corrected to permit proper installation of work.
2. Cooperation will be undertaken with other trades working in and adjacent to work areas. Drawings that show the development of the entire project will be examined

to gain familiarity with the scope of other required work..

B. Soil Preparation

1. All areas to receive landscape soil shall be free of construction debris, refuse, compressible or decayable materials, stone and standing water to a depth of 2” for landscape areas and 3” for lawn areas. Do not place fill when fill materials are wet, frozen or not at the optimum moisture content for proper compaction. Adjust sub grade levels as required to ensure that planting and lawn areas have adequate drainage. Installation of all utilities and irrigation mainlines shall be competed prior to beginning landscape soil work.
2. The Contractor shall install soil amendments over the existing soil as approved. Soil amendments shall be tilled into the soil to loosen existing soil to a depth of 8" for landscape areas, and 6" for lawn areas. Excavation is not required. Rake the area smooth and compact the subsoil not to exceed 65 percent compaction. Level and regrade planting bed prior to installation of landscape soil. Three inches of landscape soil shall be installed on top unless drawings indicate a different amount.
   4. Landscape soil shall be amended to meet the criteria of this section. Soil shall be mixed at the stockpile or off site. Amendments shall be mixed into soil by layering the soil and soil amendments in alternating thin layers (not to exceed six inches) and mixing them uniformly as each layer is added.
   5. Fill excavated areas with landscape soil amended to meet the criteria of this section. Soil shall be placed in successive lifts no thicker than six inches and compacted with hand-operated equipment to a maximum dry density of 65 percent. Over compaction of fills, which would be detrimental to planting objectives shall be corrected by loosening fills through tilling or other means and recompacting to specified limits at no additional cost to M-NCPPC.
6. The soil shall not be tilled or amended when the soil’s moisture level is above field capacity or when soil is frozen.
7. or soil preparation in critical root zone areas of existing trees, all work must be done by hand with shovels and rakes, unless otherwise approved in writing by the M-NCPPC Construction Manager.

END OF SECTION

SECTION 32 9300

LANDSCAPE

PART 1 GENERAL

A. Extent of the planting is shown on the drawings and in the schedules.

(1) Provide all labor, materials and equipment required by or inferred from the Drawings and Specifications to complete the work of this section.

(2) Providing, placing, grading topsoil for landscape grading as indicated in the Drawings.

(3) Providing and installing trees, shrubs, seeding and solid sod for landscape planting, as per details.

(4) To successfully dig existing plants and store them on or off-site during construction for replanting on-site per plans where they will reestablish and thrive.

B. Specified Maintenance Period, and One-Year Guarantee Period.

C. Verify plant count from plan, and provide and install all plant material on plan.

D. All plants shall conform to or surpass minimum quality standards as defined by the American Association of Nurserymen; current edition of American Standards for Nursery Stock published by American Association of Nurseryman, Inc. and in addition shall conform to sizes and descriptions in the plant list. All work to be performed by a firm specializing in Landscaping, not a subcontractor.

E. Substitution from the specified plant list will be accepted only when satisfactory evidence in writing is submitted to the Landscape Architect, prior to submitting bid – tree list, showing that the plant material is not available. This list shall be submitted prior to submitting bid.

(1) Requests for approval of substitute plant material shall include common and botanical names and the size of substitute material.

(2) Only those substitutions of at least equivalent size and having essential characteristics similar to the originally specified material will be approved. The Landscape Architect will issue acceptance or rejection of substitute plant material in writing.

F. Approval and selection of materials and work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the owner and Landscape Architect. They have the right to reject any and all materials and any and all Work, which in their opinion does not meet the requirements of the Contract Documents at any stage of the operations. Remove rejected Work and or materials from the Project Site and replace promptly at no additional cost to the owner.

G. Workmanship: Install all plant materials neatly.

(1) Make minor adjustments to layout as may be required and requested by Landscape Architect at no additional cost to the owner.

(2) Coordinate delivery of all plant material with time of installation to prevent any plant material from being stockpiled on site longer than 24 hours.

(3) Deliver materials in such manner as to not damage or decrease the health and vigor of the plant materials.

(4) Store materials away from detrimental elements. Coordinate with General Contractor to secure a safe staging area.

(5) Handle, load, unload, and transport materials carefully to avoid damage.

(6) Maintain and protect plant materials as necessary to insure health and vigor.

(7) Guarantee plant materials and lawn areas for one year from the date of substantial completion. Contractor shall replace plants that fail to grow properly with plants as originally specified at the earliest practical date following plant failure, without additional charges to the owner.

(8) Replacement materials will be guaranteed for one year from the date of replacement.

(9) The Contractor shall not be responsible for replacing plants that are damaged by abuse or improper maintenance by Owner as reported by Contractor outlined below or by acts of nature occurring after acceptance.

H. Acts of nature may include, but may not be limited to high winds of hurricane or tornado force, sleet, hail, freezing rain and extreme cold (as determined by the Landscape Architect). Contractor agrees to replace losses due to Acts of Nature at fifteen percent (15%) less than the original contract price for the damaged work.

I. Contractor's Periodic Inspection: During guarantee period, Contractor shall make periodic inspections of the project to satisfy himself that maintenance by the owner is adequate.

(1) Any methods or products that he deems not normal or detrimental to good plant growth shall be reported to the Owner in writing.

(2) Failure to inspect and report shall be interpreted as approval and the Contractor shall be held responsible for any and all necessary replacements.

IV. II. PART 2 – PRODUCTS

A. Topsoil: All topsoil shall be supplied from offsite stockpile and spread by the Landscape Contractor. The Landscape Contractor shall be responsible for fine grading. Topsoil shall be fertile, friable, sandy loam and a natural surface soil obtained from areas reviewed by Landscape Architect and possessing characteristics of representative soils in the project vicinity that produce heavy growths of crops, grass, or other vegetation. *REF Topsoil Specification for additional requirements..*

B. Planting Soil Mixture: Provide soil mix amended as per laboratory recommendations. Basic planting soil mix consists of:

(1) 50% topsoil (as described above)

(2) 50% prepared additives (by volume as follows)

(3) 3 parts humus (forest peat or Nature's Helper)

(4) 1 part sterilized cow manure, commercial fertilizer and lime as recommended in soil test analysis.

F. The components shall be thoroughly mixed to uniform consistency by hand or machine methods prior to placement in and around plantings.

G. Trees: All large deciduous shade trees and ornamental trees are to be field grown from rooted cuttings true to variety and not grafted material. No grafted material will be accepted for the initial installation or as guarantee replacement material.

H. Alternate Growers – Will be considered by the Landscape Architect only if submitted with photographs of specified material within 10 days from date contract is awarded to General Contractor. The Landscape Architect will select and tag 100% of plant materials from acceptable alternate growers. The contractor will be responsible for all expenses related to tagging trips to alternate growers including usual fees charged by the Landscape Architect. The Contractor shall arrange for and provide transportation for the Landscape Architect. Contractor shall provide the Landscape Architect a minimum of three weeks advance notice. Contractor shall limit tagging trips to no more than two at a maximum of two days each. All tagging trips will be completed within 45 days from date contract is awarded to General Contractor.

I. Contractor will submit confirmed orders from acceptable alternate growers within ten days of tagging by the Landscape Architect. Contractor is responsible for payment of deposits required by acceptable alternate growers.

J. Fertilizer: Fertilizer for all trees, plants and ground covers shall be Sta-Green Nursery Special delivered to the site in unopened containers.

K. Fertilize all areas according to the manufacturer's recommended rates in accordance with the monthly maintenance guideline herein.

L. Cultivate and waterbeds or pits thoroughly after application.

M. Adjust fertilizer in accordance with interim soil test reports.

N. Fertilizer for sod: Fertilizer for sod shall be Sta-Green and sod fertilizer containing the following percentages by weight:

18% nitrogen
24% phosphorous
10% potash

O. Nursery Special or approved equal.

P. Fertilizer shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original, unopened container, bearing the Manufacturer's guaranteed analysis. Fertilizer shall not have been exposed to weather prior to delivery to the site. After delivery, until used, it shall be completely protected at all times. It shall not be stored in direct contact with the ground.

Q. Plants: All plants shall conform to or surpass minimum quality standards as defined by the American Association of Nurserymen (AAN), current edition of American Standard for Nursery Stock published by the ANN, Inc. and in addition, shall conform to sizes and descriptions in the plant list.

R. Certificates of Inspection for Plant Material: All necessary Inspection certificates shall be supplied, if requested, to the Landscape Architect's representative for each shipment of plant material, as required by law. Certificates showing source of origin shall be filed with Landscape Architect prior to acceptance of the material.

S. Inspection: All plant materials shall be subject to inspection and approval. The Landscape Architect reserves the right to reject any and all plants that fail to meet this specification at any point during the installation of the job. The Contractor at no additional cost shall promptly remove all rejected materials from the site to the owner.

T. Quality and size: All plant materials furnished shall be well branched, proportioned width to height, or normal habit, sound, healthy and vigorous in growth. The minimum acceptable sizes of plants shall be measured before pruning with branches in normal position and shall conform to measurements specified. Plants used where symmetry is required shall be matched as closely as possible. It is the responsibility of the Landscape Contractor to determine from the planting plan where matching plants should be used. Ask for clarification by Landscape Architect when necessary and do so before bids are submitted. Plants shall meet all requirements as listed in the plant list.

U. Source of Plants: Plants shall be field nursery, container grown or collected material subject to the requirements of the Specifications.

V. Field Tagged Plants: All deciduous and evergreen trees are to be sourced by the contractor at any of the approved nurseries, of the provided list, or equal as approved by the Landscape Architect. The owner will pay the Landscape Architect for tree tagging trips. The contractor should anticipate accompanying the Landscape Architect on the tagging trips but is not required to do so.

W. Insect, Pests and Plant Diseases: All plants shall be of healthy stock, free from disease, insects, eggs, larvae and parasites of an objectionable or damaging nature.

X. Substitutions: Substitutions from the specified list will be accepted only when satisfactory evidence in writing is submitted to the Landscape Architect, showing that the plant specified is not available. Requests for approval of substitute material shall include common and botanical names and size of plant material. Only those substitutions or at least equivalent size and having the essential characteristics similar to the originally specified material will be approved. The Landscape Architect will issue acceptance or rejection of substitute plant materials in writing. Substitutions may be made only prior to bidding.

Y. Balled and burlapped plant material are to be wrapped with organic burlap wrapping only. Synthetic material will not be accepted. Remove all nursery-loading straps once plant material is placed in the pit.

Z. Guying of trees: Stakes for supporting trees shall be sound timber, straight, sized as shown in planting details and of sufficient length to adequately support the plant. All visible surfaces shall be painted flat black.

AA. Deadmen or stakes for anchoring guy wires in the ground shall be of size, material and strength adequate to hold guy taut and maintain tree firmly in an upright position.

BB. Wire shall be # 12 gauge galvanized wire in double twisted strand to adjust tension.

CC. Hose for encasing guy wires shall be new or suitable used 3/4" diameter rubber or plastic garden hose, black in color.

DD. Mulch: Pine bark mulch shall be clean, fresh, free of noxious weeds, seed, fire ants, Japanese beetles and/or fringed beetles.

GG. Sod: Sod shall be 100% specified grass, free of weeds, freshly dug.

HH. Inoculants: Pure culture of nitrogen-fixing bacteria prepared specifically for the legume species. A mixing medium as recommended by the manufacturer shall be used to bond the inoculant to the seed.

JJ. All necessary hand tools and materials typically used in planting operations.

KK. Plastic labels or tags on which identification can be made.

LL. Milorganite 5-1-1 fertilizer

MM. 'Nature's Helper' Soil conditioner

NN. Follar insecticide as needed to control damage

OO. Anti-desiccant spray for minimizing transpiration during storage

PP. Bailing twine

QQ. Burlap – 36" wide, rolled.

V. PART 3 – EXECUTION

A. Execution of Digging and Holding: All transplanting work, and storage of plants is to be carefully coordinated with the General Contractor. Prior to digging, thoroughly water all plant material to be dug to moisten the root area.

Deep water each plant and follar mist in the first day to help the plant transition. Monitor the water and mist during the first week and until the digging occurs. Not less than one week after the root pruning carefully dig each plant by using the shovel to raise the plant slowly and onto a sheet of burlap cloth twice the size of the root ball. The plant should be then carried to the holding area supported equally on all four corners. When the plant is laid down in the holding area, the burlap is to be folded over the root ball/mass and secured with bailing twine. Then cover the entire root ball with a soil conditioner. Clum's "Nature's Helper" or approved equal, and thoroughly water. Do not allow the rootball/mass dry out during the transplanting process. All dug plants are to be maintained and watered continuously where held until such time that they can be replanted. Maintenance should include pruning to thin, removal of dead branches, wilt-proof sprayings, insect treatments, etc., in addition to regular watering.

Root Ball Size:: Reference Nursery Standards

B. Layout of major plants: Before commencing planting operations, location of major plants and outlines of areas to be planted shall be marked out on the ground, by the Contractor for approval by the Landscape Architect. Contact the Landscape Architect a minimum of 24 hours in advance of the anticipated review of the layout.

C. Time and planting: Planting operations shall be during favorable weather in which conditions are neither extremely cold nor hot, nor to a point that the risk of loss is too great. The Contractor shall inform the Landscape Architect of high risks due to weather.

C. Preparation of planting beds: Landscape Contractor will provide and spread 4" topsoil and provide finish grades in all planting beds. The Landscape contractor will fine grade and provide minimum 3% positive drainage in all beds. This is to include debris removal and any grading required bringing the finished grade to the proper level for planting trees, shrubs and ground covers. Landscape Contractor shall grade for proper drainage. Contractor shall anticipate and allow for settling of soils.

E. Circular plant pits with vertical sides shall be dug by hand or machine methods for planting and transplanting of trees and shrubs. Sides of pits should be scarified to allow for water percolation.

F. Shrub pit diameter shall be a minimum of one foot greater than the spread of the root mass.

G. All transplanted material is to be replanted the same day it is dug.

H. Test excavated plant pits to determine if sufficient drainage is present for proper plant survival.

I. Fill the area between the pits, if the individual pits are arranged in a group, to the required grade with pine bark mulch to a depth of 3". Plant beds shall be neatly edged and kept free of weeds until the work is accepted.

J. Excavation for planting ground covers: Ground cover beds shall be scarified by hand or machine method to a minimum depth of 8". 4" of pine bark additive and 20 lbs. / 1000 sq. ft. of Sta-Green Nursery Special fertilizer shall be uniformly incorporated into the soil to the full 6" of minimum depth.

K. Drainage test for trees: Tree pits shall be filled with water. If percolation is less than 100% within a period of twelve hours, drill a 12" auger to a depth of 4' below the bottom of the pit. Retest the pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing of the condition before planting the trees in the questionable areas. Contractor is fully responsible for warranty of the trees.

L. Drainage Test for Plants and Ground covers: Plants and ground cover beds shall be spot tested.

(1) Dispose of topsoil removed from landscape excavations. Do not mix with the planting soil. Do not use as back fill or to construct saucers around pits.

(2) Balled and container plants shall be placed firmly upon scarified sub-grade and back filled with planting soil mixture. Remove all wire, cords, and burlap from top of root ball. Hand tamp carefully around and under ball to fill all voids. Water during back filling. Form saucer from planting soil mixture in order to retain water.

(3) Gently loosen outer roots of container grown plants to encourage outward growth.

(4) Fertilizer shall be thoroughly mixed and soaked into the top two inches of soil for all plant pits.

M. Setting plants: Set plants uniformly 2-4" higher than surrounding grade or as necessary to provide adequate positive drainage away from roots. Slope soil gradually from saucer.

(1) Cut rope, wire or string from top of ball after plant has been set; turn down and bury burlap.

N. Tree transportation: The Contractor shall be responsible not only for the safe transportation of the plants to the site but also their condition upon arrival. Trees with abrasions of the bark, sunscalds, fresh cuts, or breaks of limbs that have not completely callused will be rejected. The Contractor at no additional cost will replace trees that have been damaged during transit. All plant unit costs will reflect all above listed specifications.

O. Tree tags: All plants accepted at the nursery by the Landscape Architect shall be tagged with serialized self-locking tags. Trees delivered to the site without these tags or with broken tags will be rejected. The tags shall remain on the trees until the Landscape Architect for their removal has given the Contractor instructions.

(1) Tree tags shall be removed immediately following the final Punch-list. The Contractor will replace any trees on which tags remain and become in grown.

P. Stockpile of trees: All plant material stored on site will be untied and/or cut loose for proper storing and inspections periodically.

Q. Pruning deciduous trees: Deciduous trees and shrubs shall be pruned only to thin out heavy growth.

(1) Do not top or remove terminal growing point or leader of any plant.
(2) Cuts over 3/4" in diameter shall be painted with tree dressing paint. No paint containing lead shall be permitted.

R. Guy trees 2" caliper and over: Space three guys equally about each tree, attached at approximately two-fifths up the trunk. Guys should be at a 45-degree angle from the ground plane and anchored in the ground with stakes. Guy to trunks with wire loops and black rubber hose drawn snug in all directions. These guys shall be equally taut.

(1) Wrap trunks of deciduous trees larger than 2" caliper spirally with standard paper or fiber wrapping material from the base of the trunk to the second branch and the wrapping secured in place. Wrap the trunk with the plain side of wrapping to the outside with no writing visible. Tie off wrapping with sisal yarn at 24" intervals.
(2) Stake trees less than 2" caliper with two wood stakes driven two feet into the ground with the portion extending above the ground approximately ½ of the trunk height. Stake 12" from trunk, fastened at approximately two-fifths of trunk height with wire run through rubber hose.

S. Mulch all planting beds and other areas designated to be mulched, with 3" "settled" depth of specified mulch type. Individual plants are to be mulched as detailed. Mulch is to be measured after settlement and maintained as specified.

T. Preparation of lawn areas: Fine grade all lawn areas to finish grade. All areas shall have smooth and continual grade between the existing and fixed controls such as walks and curbs. Roll, scarify, rake and level as necessary to obtain true, even and firm lawn surfaces. All finished grades shall meet approval of the Landscape Architect before sodding or seeding operations begin.

U. Areas to receive sod: Landscape Contractor will provide 4" topsoil & grade to finish grade all areas to receive sod. The Landscape Contractor will be responsible for fine grading. This is to include debris removal and any grading required bringing the finished topsoil grade to the proper level for applying sod.

(1) On this grade spread specified fertilizer as per manufacturer's recommendations and lime at a rate of 50 lbs. / 1000 sq. ft. evenly over all areas to receive grass. A soil test

shall be made prior to the beginning of fertilizing and liming and the quantities of the lime and fertilizer shall be adjusted, if necessary, to achieve a pH of 6.0 to 7.0.

(2) Scarify prepared grade to depth of 6" thoroughly incorporating fertilizer and lime into the top 6" of existing soil in all areas to be grassed. Caution shall be exercised to avoid damage to underground utilities. All building debris, vegetation, sticks and stones over 3/4" in any dimension shall be removed and the surface leveled and smoothed.

V. Sodding operations: Delivery of sod shall be scheduled so as to allow laying of sod without delay. No sod shall remain stacked longer than 24 hours. In the event that sod cannot be laid immediately upon delivery, Contractor shall lay sod on a designated site, to be approved by the Landscape Architect. No sod shall overlap and it shall be lightly watered as necessary to keep moist.

(1) Lay sod when bed is not excessively wet or frozen, but when soil is moist to the depth of 2" minimum.

(2) Lay sod so that no voids occur. Sod shall be tamped and rolled by hand methods. The completed surface shall be true to finish grade and even and firm at all points. Stagger the sod seams / joints.

(3) Do not move heavy objects over areas to be sodded after the soil has been prepared.

W. Removal of existing grass: The Landscape Contractor is to remove existing grass and weeds from all areas for planting and resodding as designated on the plans. The existing stands are to be removed to a maximum depth of 1" so as not to disturb existing tree roots where present in those areas.

(1) Aerate with a tined tiller to break up the upper 3" lightly not to damage tree roots. Pick up solids for discarding and cut cleanly any roots damaged.

(2) Spread a light layer of topsoil not more than 1" in depth over the aerated area and fine grade to meet acceptance by the Landscape Architect. Apply fertilizer and lime to these areas as specified previously under "Areas to receive sod" or "Preparation of planting beds" whichever the case may be.

VI. PART 4 - CLEANUP & PROTECTION

A. Keep project site clean and orderly during planting operations.

B. Clear grounds of debris, superfluous materials and all equipment upon completion of Work. Remove from site to the satisfaction of the Landscape Architect and Owner.

C. Protect all work and materials from damage due to landscape operations and operations by other contractors, trades and trespassers. Maintain protection until Date of Substantial Completion.

D. Contractor is responsible for theft of equipment and material at the job site before, during and after installation, until Date of Substantial Completion of Work in total.

VII. V. PART 5 - LANDSCAPE MAINTENANCE GUIDELINES

A. Begin maintenance at commencement of Work of this section and continue until Substantial Completion, as part of Work of this section.

B. Continue maintenance for a Maintenance Period of thirty calendar days after date of Substantial Completion.

C. Provide labor, materials, equipment and means for proper maintenance of all materials and workmanship.

D. Supervision: submit a written report and conduct joint inspection with Landscape Architect maintenance program and procedures, at inspection for Substantial Completion.

E. Maintenance of trees, shrubs, sod and seed: Maintain all plants in a growing, well formed, healthy condition by watering, fertilizing, pruning, weeding, spraying, wrapping, straightening, replacement or by other necessary maintenance operations.

F. Watering: Monitor owner's automatic watering system and schedule for proper watering of all plant material.

G. Advise Landscape Architect immediately in writing of recommended alterations due to weather or other conditions.

H. Water landscaped areas not covered by automatic watering system as frequently as necessary to maintain proper moisture level, using the following schedule as a guide:

I. Twice a month during March, April, May

J. Once a week during June, July, August, September

K. No watering from October through February, except in drought conditions

L. Fertilizing:

Mid March application of 23-3-3 (slow release nitrogen)
April 1 application of iron chalet
Mid April application of 12-6-6
August 1 application of 15-0-15

M. Mowing: Mow grass to a height of 2-2 1/2" when it reaches a height of 3", or as directed by Landscape Architect. Seeded and sodded lawns shall have at least one mowing before receiving Substantial Completion.

N. Resodding: Rework and resod areas that fail to show a uniform stand of grass. Perform work with the same kind of sod applied and repeated until all areas are covered with a uniform stand of grass.

O. Reseeding: Rework and reseed areas, which fail to show a uniform stand of grass. Perform work with the same kind of seed applied and repeated until all areas are covered with a uniform stand of grass.

P. Site annual planting: Replace annual plantings according to schedule in Drawings. Blooming plants shall be in bloom at the time of planting and shall be replaced as necessary throughout specified Maintenance Period to maintain blooming condition.

Q. Pruning: Remove dead wood as it becomes evident. Remove living portions of plants only at the direction of Landscape Architect.

R. Wilt-proofing: Apply approved anti-desiccant to all evergreen trees during last two weeks of October (except pines).

S. Spraying: For each spraying combine approved insecticide and fungicide to provide maximum protection for all plant materials. Three sprayings annually; in March, May and August.

T. Weeding: Two applications (Spring and Fall) of chemical pre-emergent spray, approved. Two applications (during growing season) of chemical contact spray (Round-up, by Monsanto, or approved equal). Two days per month (every two weeks) manual weeding (by hand) during the period from March 1 through September 30; remove all visible weeds.

U. Mulching: Keep planting areas neat and uniformly mulched to specified depth on a continuous basis. In addition to replacing and re-spreading mulch as necessitated during the maintenance period completely replenish mulch in all planting areas one time (during the last month of the one-year guarantee period or as directed by the Landscape Architect.)

V. Straightening: Maintain plants in their stable upright position and at the proper grade by straightening and tightening staking and guying apparatus and as approved by the Architect.

W. Clean-up: Keep all planting areas neat, weeded and uniformly mulched on a continuous basis. Clean up adjacent walks and pavement where lettered as a result of maintenance operations, on a continuous basis.

(1) The 30-day maintenance period following Substantial Completion will be considered a lump sum item to be addressed as an item included in the contract.

VIII. VI. PART 6 - ACCEPTANCE & GUARANTEE

A. Substantial Completion: Submit written requests for inspection for Substantial Completion to the Landscape Architect at least three calendar days prior to anticipated date of inspection and testing.

B. Substantial Completion cannot be granted and at the same time no further applications for payment shall be for more than 85% or less if the owner requests of the Contract until there has been a walk-through for planting at which time a “punch-list” will be written consisting of items to be addressed and corrected by the Contractor immediately. Depending on the extent of work on the “punch-list”, the Landscape Architect will determine the job to be “Substantially Complete” or pending the completion of the “Punch-list”.

C. Submit Record Drawings and Maintenance manuals to the Landscape Architect with written request for inspection.

D. Review the “punch-list” work jointly with the Owner and Landscape Architect for Substantial Completion of the total (contract) work. (See “General Conditions” Article No. 9).

E. Upon completion of repairs and replacements found necessary at the time of review, the Owner and Landscape Architect will confirm the date of Substantial Completion and issue the written notice if all items on the punch-list have been completed. If necessary, another punch list will be written to itemize any deficiencies still existing and will be attached to the written notice. The contractor shall complete all “punch-list” items if possible within 30 days while continuing maintenance.

F. The date of Substantial Completion will constitute the beginning date of the One-Year Guarantee. This date also constitutes the beginning of warranty responsibilities and acceptance by the Owner and Landscape Architect.

G. Guarantee all work, products, equipment and materials for one year, beginning at the Date of Substantial Completion as per written notice.

H. Make good any damage, loss destruction or failure. Repairs and replacements shall be done promptly and at no additional cost to the Owner.

I. Repair damage to grade, plants and other work as necessary.

J. If the replacement is not acceptable during or at the end of the Guarantee Period, the Owner may elect either subsequent replacement or credit. Replacement products shall have a similar one-year guarantee from the time of replacement.

END OF SECTION

SECTION 33 0110

DISINFECTION OF POTABLE WATER SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 - Liquid Chlorine.
   3. AWWA B302 - Ammonium Sulfate.
   4. AWWA B303 - Sodium Chlorite.
   5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   6. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certify water conforms, or fails to conform, to bacterial standards of Alabama Department of Environmental Management.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

1.6 QUALIFICATIONS

A. Testing Firm: Company specializing in testing potable water systems.

B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform the Work of this section.

B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 05 05.

C. Introduce treatment into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted
2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

SECTION 33 0505

SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing Manholes:
      a. Vacuum Test.
   2. Testing Gravity Sewer Piping:
      a. Low-pressure Air Test.
      b. Infiltration Test.
   3. Hydrostatic Testing Pressure Piping.
   4. Deflection Testing Plastic Piping.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
   2. ASTM D2122 - Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Submit the following prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gauge calibration.
   6. Deflection mandrel drawings and calculations.

C. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS

2.1 VACUUM TESTING EQUIPMENT

A. Vacuum pump.

B. Vacuum line.

C. Vacuum tester base with compression band seal and outlet port.

D. Shut-off valve.

E. Stop watch.

F. Plugs.

G. Vacuum gauge, calibrated to 0.1 inch Hg

2.2 AIR TEST EQUIPMENT

A. Air compressor.

B. Air supply line.

C. Shut-off valves.

D. Pressure regulator.

E. Pressure relief valve.

F. Stop watch.

G. Plugs.

H. Pressure gauge, calibrated to 0.1 psi.

2.3 INFILTRATION TEST EQUIPMENT

A. Weirs.

2.4 HYDROSTATIC TEST EQUIPMENT

A. Hydro pump.

B. Pressure hose.

C. Water meter.

D. Test connections.

E. Pressure relief valve.

F. Pressure gauge, calibrated to 0.1 psi.

2.5 DEFLECTION TEST EQUIPMENT

A. Go, No-Go mandrels.

B. Pull/retrieval ropes.

PART 3 EXECUTION

3.1 E**XAMINATION**

A. City of Gadsden Division 105- General Conditions

B. Verify manholes and piping are ready for testing.

C. Verify trenches are backfilled.

D. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

A. Plug outlets, wye-branches and laterals; brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Testing Gravity Sewer Piping:
   1. Low-pressure Air Test:
      a. Test each section of gravity sewer piping between manholes.
      b. Introduce air pressure slowly to approximately 4 psig.
         1) Determine ground water elevation above spring line of pipe for every foot of ground water above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
      c. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when ground water is present. Start test.
      d. Test:
         1) Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

AIR TEST TABLE

Minimum Test Time for Various Pipe Sizes

Pipe Dia. (inches)	T(time), min/ 100 feet
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
36	6.0

2) Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.
3) When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.

2. Test pipe larger than 36 inches diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.
3. Infiltration Test:
   a. Use only when gravity piping is submerged in ground water minimum of 4 feet above crown of pipe for entire length being tested.
   b. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test, include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.

C. Testing Pressure Sewer Piping:
1. Hydrostatic Leakage Test:
   a. Hydrostatically test each portion of pressure piping, including valve section, at 1.5 times working pressure of piping based on elevation of lowest point in piping corrected to elevation of test gauge.
   b. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.
   c. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
   d. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or

minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

e. Compute maximum allowable leakage by the following formula:

$$L = \frac{SD\sqrt{P}}{C}$$

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
p = average test pressure during leakage test, in psig
C = 133,200

When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

f. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

D. Deflection Testing of Plastic Sewer Pipe:

1. Perform vertical ring deflection testing on PVC and ABS sewer piping, after backfilling has been in place for at least 30 days but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe limited to 5 percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
5. Perform test without mechanical pulling devices.
6. Locate, excavate, replace and retest pipe exceeding allowable deflection.

E. Testing Manholes:

1. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
2. Vacuum test in accordance with ASTM C1244 and as follows:
   a. Plug pipe openings; securely brace plugs and pipe.
   b. Inflate compression band to effect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
   c. Test:
      1) Determine test duration for manhole from the following table:

VACUUM TEST TABLE

Manhole Diameter	Test Period
4 feet	60 seconds
5 feet	75 seconds
6 feet	90 seconds

2) Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
3) When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION

SECTION 33 0507

CASING PIPE AND TUNNEL LINER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation for approach trenches and pits.
2. Casing pipe and Tunnel liner.
3. Carrier pipe.
4. Casing Spacers.

B. Related Sections:
1. Plans and general provisions of the Contract including General and Supplemental **General Conditions, and Technical Specifications.**

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Casing by Jack and Bore:
1. Basis of Measurement: Linear Foot based on the size, material, and special coating (if required) shown on the Plans and reflected on the Bid Form.
2. Basis of Payment: Includes all labor and equipment associated with excavation of trenches and pits (including rock excavation), sheet piling, clearing, dewatering, boring to grade specified in the plans, casing pipe, carrier pipe installed within the casing, spacers and end seals, jacking, thrust walls, backfill, compaction, topsoil spreading, seeding, mulching, restoration of existing structures damaged by construction, traffic control, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist.

B. Casing by Open Cut:
1. Basis of Measurement: Linear Foot based on the size, material, and special coating (if required) shown on the Plans and reflected on the Bid Form.
2. Basis of Payment: Includes all labor and equipment associated with excavation of trenches and pits (including rock excavation), sheet piling, clearing, dewatering, boring to grade specified in the plans, casing pipe, carrier pipe installed within the casing, spacers and end seals, jacking, thrust walls, backfill, compaction, topsoil spreading, seeding, mulching, restoration of existing structures damaged by construction, traffic control, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist.

C. Tunnel Liner:
1. Basis of Measurement: Linear Foot based on the size shown on the Plans and reflected on the Bid Form.
2. Basis of Payment: Includes supply, installation and engineering design of liner plates for tunnel and vertical tunnel shaft, clearing, topsoil stripping, excavation (including rock excavation) for tunnel, pits and vertical shaft, haul-off of any muck

material, grouting of annular space between excavation and liner plates, supply and installation of carrier pipe, grout cradle, carrier pipe anchoring materials and equipment, sand backfill, brick and mortar tunnel end seals, No. 57 crushed stone backfill for vertical tunnel shaft, compaction, topsoil spreading, seeding, mulching and erosion control, restoration of existing structures damaged by construction, dewatering, maintaining wastewater flow (if applicable), testing, traffic control, as-built drawings and other items shown in the Plans.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Railway Engineering and Maintenance-of-Way Association:
1. AREMA - Manual for Railway Engineering.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
4. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
5. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot- Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low- Alloy with Improved Formability.
6. ASTM C33 - Standard Specification for Concrete Aggregates.
7. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
10. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
11. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
12. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
13. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
14. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
15. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C3 - Piles - Preservative Treatment by Pressure Process.

E. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

F. National Utility Contractors Association:
   1. NUCA - Pipe Jacking & Microtunneling Design Guide.
   2. NUCA - Trenchless Excavation Construction Equipment & Methods Manual.

1.4 DESIGN REQUIREMENTS

A. Design casing pipe and tunnel liner joints of leak proof construction. Design for earth and/or other pressures present plus highway H20 loading or railway E80 loading with associated recommended impact loading.
   1. Highway Crossings: Design tunnel for earth and/or other pressure loads present, plus AASHTO H20 live loading.
   2. Railroad Crossings: Design tunnel for earth and/or other pressure loads present, plus railroad E80 live loading with 50 percent added for impact.

B. Design bracing, backstops, and use jacks of sufficient rating for continuous jacking without stoppage, except for adding pipe sections and as conditions permit, to minimize tendency of ground material to "freeze" around casing pipe.

C. Design steel tunnel lining in accordance with AREMA Manual for Railway Engineering, Section 4.15.5.

1.5 SUBMITTALS

A. City of Gadsden Division 105 - General Conditions

B. Shop Drawings: Prepare scaled shop Drawings to supplement Contract Drawings, signed and sealed by Professional Engineer registered in the State of Alabama.
   1. Include details of casing, jacking head, sheeting, and other falsework for trenches and pits, and support for facility, field sketches, and other details, to complete the Work.
   2. Show relation of proposed installation to facility over installation, angle of installation, right-of-way lines and general layout of built facilities.
   3. Show cross section or sections from field survey, showing installation in relation to actual profile of ground.

C. Design Data: Submit tunnel liner design calculations and manufacturer's data on tunnel liner plate showing sizes, shapes, methods of attachment and connection details, and details of grout holes, signed and sealed by Professional Engineer registered in Alabama,

D. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.

E. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment.

F. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.

G. Submit written report results of visual check prior to installation of carrier pipe of entire length of casing/liner, to verify there are neither voids nor defective joints.

1.6 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105 - General Conditions

B. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with Alabama Department of Transportation Standard, NUCA Trenchless Excavation Construction Equipment & Methods Manual, NUCA Pipe Jacking & Microtunneling Design Guide, and AREMA guidelines.

B. When boring, jacking or tunneling under State highways and railroads, Contractor to have permit on-site and shall notify highway or railroad inspector a minimum of three days prior to beginning bore/tunnel.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum five years experience.
   1. Work Experience: Include projects of similar magnitude and conditions.
   2. Furnish list of references upon request.

B. Design tunnel installation and load bearing falsework under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of Alabama.

1.9 DELIVERY, STORAGE, AND HANDLING

A. City of Gadsden Division 105 - General Conditions

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.

E. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than 3 layers high.

F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.

G. Support casing and carrier pipes with nylon slings during handling.

1.10 ENVIRONMENTAL REQUIREMENTS

A. City of Gadsden Division 105 - General Conditions

B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.11 FIELD MEASUREMENTS

A. Verify invert elevations prior to excavation and installation of casing/tunnel.

B. Verify casing spacers are properly sized for the carrier pipe and casing pipe.

C. End seals are required unless specifically excluded in the Plans.

1.12 COORDINATION

A. City of Gadsden Division 105 - General Conditions

PART 2 PRODUCTS

2.1 WELDED STEEL CASING PIPE

A. Shall be new, smooth wall, welded steel pipe conforming to the latest requirements of ASTM A53/A53M with a minimum yield strength of 42,000 psi.

B. The diameter and wall thickness shall be either as indicated in the Plans, or as reflected below based on the nominal diameter of the carrier pipe:

Carrier Pipe Nominal Diameter (inches)	Steel Encasement Pipe Diameter (inches)	Steel Encasement Pipe Minimum Wall Thickness (inches)
3	6	0.188
4	8	0.188
6	12	0.250
8	16	0.250
10	20	0.250
12	20	0.250
14	24	0.375
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.500
30	42	0.500

2.2 STEEL TUNNEL LINER MATERIAL

A. Plates: ASTM A1011/A1011M, structural steel, minimum Grade 40.

B. Bolts and Nuts Used with Lapped Seams:
1. Bolts and Nuts: Not less than 5/8 inch in diameter.
2. Bolts for Plate Thicknesses Greater Than or Equal to 0.209 inches: ASTM A449.
3. Bolts for Plate Thicknesses Less Than 0.209 Inches: ASTM A307.
4. Nuts: ASTM A307, Grade A.

C. Bolts and Nuts Used with Four Flanged Plates:
1. Bolts and Nuts: ASTM A307, Grade A, quick-acting course thread, not less than 1/2 inch in diameter for plate thicknesses to and including 0.179 inch and not less than 5/8-inch diameter for plates of greater thickness.

2.3 CARRIER PIPE MATERIALS

A. Water Distribution System Piping: As specified in Section 33 14 16.

B. Sanitary Sewage System Piping: As specified in Section 33 31 13.

C. Storm Drainage Piping: As specified in Section 33 40 00.

2.4 GROUT AND COVER MATERIALS

A. Soil Backfill for Trench Approaches and Pits to Finish Grade: Soil as specified in Section 31 00 00.

B. Fill and Seal Grout at Pipe Ends: Concrete grout fill as specified in Section 32 16 00.

C. Pressure Grout Mix: One-part Portland cement, and 6 parts mortar sand mixed with water to consistency applicable for pressure grouting.

2.5 CASING SPACERS

A. Casing spacers shall be used to fully support and protect the carrier pipe during installation into the casing pipe.

B. Casing spacers shall be a two-piece shell made from 14 gauge 304 stainless steel.

C. Each shell section shall have a flange formed with ribs for strength.

D. Each shell shall be lined with a ribbed PVC extrusion with a retaining ridge that overlaps the shell to prevent slippage.

E. The runners and risers shall be attached at appropriate positions to properly support the carrier pipe within the casing and to ease installation. The runners shall be made of ultra high molecular weight polymer (UHMW) and shall be attached mechanically with bolts welded for strength.

F. All risers shall be 10-gauge 304 stainless steel, MIG welded to the shell.

G. Casing spacers shall be spaced a maximum of ten (10) feet apart along the length of the carrier pipe with one casing spacer within two (2) feet of each side of a pipe joint and the rest evenly spaced. Wood skids are not an acceptable method of supporting the carrier pipe.

2.6 ACCESSORIES

A. Supports and Insulators:
   1. Timber:
      a. Construction: Cross-sectional sized to allow placement of carrier pipe in casing and to support barrel of carrier pipe. Provide notches to accommodate fastening. Treat notches at time of pipe installation.
      b. Wood Preservative or Pressure Treatment: AASHTO M133, Creosote, Chromated Copper Arsenate.
   2. Steel and Plastic: 14 gage stainless steel band, 5/16 inch stainless steel flange bolts, heavy duty PVC liner, polyethylene or phenolic skids.
   3. Plastic: Polyethylene casing insulator band and skids with stainless steel bolts.

B. Steel Strapping: ASTM A36/A36M.

C. Tunnel Liner Zinc Coating: As Specified in Plans.

D. Tunnel Liner Bituminous Coating: As Specified in Plans.

E. End Seals: 1/8-inch synthetic rubber with T-304 stainless steel banding straps.

2.7 FABRICATION - STEEL TUNNEL LINER

A. Fabricate plates to fit cross section of tunnel for connection by bolts on both longitudinal and circumferential seams and joints for erection from inside.

B. Provide grout holes 2 inches or larger in diameter in accordance with Plans to permit grouting as erection of liner plates progresses.

C. Plate Size and Weight:
1. Width: 18 inches.
2. Length: Provide plate lengths adequate to handle circumferential wall coverage in two or more multiples equivalent to 6, 12, 14, or 16 inches of diameter.
3. Weight: Hold maximum weight of single plate without bolts to 90 pounds.

D. Plate Joints: Punch plates for bolting on both longitudinal and circumferential seams or joints and fabricate as to permit complete erection from inside.
1. Circumferential: Provide bolt spacing in circumferential flanges not more than 9- 1/2 inches center to center and in multiple of plate length so plates having same curvature are interchangeable and permit staggering of longitudinal seams.
2. Longitudinal:
a. Four-Flanged Plates: Punch longitudinal flanges to accommodate 3 bolts in 16 inches plate width.
b. Two-Flanged Plates: Punch longitudinal lapped seams to accommodate 4 bolts per foot.
3. Plate Configuration: Cold form plates to provide pattern of corrugations or panels in skin section, which, along with circumferential flanges develop effective sectional properties shown in AREMA Manual for Railway Engineering, Table 4- 38.

E. Coatings:
1. Galvanized Liner Plates: As Specified in Plans.
2. Bituminous Coating: As Specified in Plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105 - General Conditions.

B. Verify connection to existing piping system, size, location, and invert elevations are in accordance with Plans.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Notify utility companies prior to beginning work.

D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Establish elevations of casing/tunnel with not less than 3 ft of cover.

3.3 DEWATERING

A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.

B. Develop substantially dry subgrade for prosecution of subsequent operations.

C. Comply with State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.4 EXISTING WORK

A. Maintain access to existing facility and other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.5 PITS OR APPROACH TRENCHES

A. Excavate approach trenches or pits as site conditions require.

B. Ensure casing/tunnel entrance face as near perpendicular to alignment as conditions permit.

C. Establish vertical entrance face at least 1 foot above top of casing/tunnel lining.

D. Install dewatering measures and excavation supports as needed.

3.6 CASING PIPE INSTALLATION

A. Boring:

1. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
2. When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
3. When voids develop greater than outside diameter of pipe by approximately one inch, grout to fill voids.
4. When boring is obstructed, relocate, jack, or tunnel as directed by Engineer.

B. Jacking
   1. Construct adequate thrust wall normal to proposed line of thrust.
   2. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

C. Open Cut
   1. Saw cut existing asphalt or concrete paving no less than three feet on each side of the centerline of the casing pipe.
   2. Excavate trench for installation of casing pipe as per Section 31 23 16.
   3. Place 6" of Type A2 aggregate in bottom of trench under the required casing.
   4. Backfill trench with dense grade base material as per Section 32 11 23.
   5. Install casing spacers and carrier pipe in the casing.
   6. Patch road with asphalt or concrete matching the existing surface.

3.7 TUNNELING

A. Advance excavation for tunnel lining in increments sufficient for erection of one ring of liners and install liner plates immediately after each increment of excavation. Excavate to minimize voids behind liner plates. Force grout voids immediately using pressure necessary to completely fill voids.

B. Excavate to lines, grades, dimensions and tolerances on Plans, to accommodate initial support and permanent lining.

C. Installation of Tunnel Linings
   1. Install tunnel lining in manner that will not damage lining or coating.
   2. Ensure edges are clean and free from material capable of interfering with proper bearing.
   3. Install liner plates and bolts in accordance with liner plate manufacturer's recommendations. Replace liner plates or bolts not meeting these requirements.
   4. Use liner plates for full length of tunnel of one type only, either flanged or lapped seam type of construction.

D. Place concrete invert.

3.8 PRESSURE GROUTING

A. Pressure grout annular space between casing pipe and surrounding earth.

3.9 CARRIER PIPE INSTALLATION

A. Clean, inspect, and handle pipe in accordance with Section 33 14 16.

B. Place carrier pipe in accordance with Section 33 14 16. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.

C. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.

3.10 TOLERANCES

A. Do not over cut excavation by more than 1 inch greater than outside diameter of casing pipe.

B. Install casing pipe to vertical and horizontal alignment on Plans within plus or minus 3 inches prior to installation of carrier pipe.

C. Install pipe bells with minimum 1/2-inch clearance to casing.

END OF SECTION

SECTION 33 0531

PRECAST MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular precast concrete manholes with tongue-and-groove joints, flexible boots, frame, covers, anchorage, and accessories.
2. Doghouse manhole connections to existing sanitary sewer lines.
3. Joint seals.
4. Bedding and cover materials.
5. Pile support systems.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Solid Masonry Units Made from Clay or Shale).
4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C55 - Standard Specification for Concrete Brick.
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawings: Indicate structure locations, elevations, piping, sizes and elevations of penetrations.

C. Product Data: Submit manhole covers, component construction, features, configuration, and dimensions.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 MANHOLES

A. Manufacturers:
1. Hanson Pipe and Precast
2. Sherman-Dixie Concrete Industries.

B. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C443.
1. Joints for Precast Manholes and Structures: In accordance with ASTM C913; maximum leakage of 0.025 gallons per hour per foot of joint at 3 feet of head.

2.2 FRAMES AND COVERS

A. Manufacturers:
1. East Jordan Iron Works
2. John Bouchard and Sons Co.
3. Neenah Foundry Co.

Substitutions: City of Gadsden Division 105- General Conditions

B. Product Description: ASTM A48, Class 30B Cast iron construction.
1. Lid: Machined flat bearing surface, removable lid, solid cover design; traffic load rated; sealing gasket (watertight model only).
2. Nominal Lid Size: 24-inch diameter opening.

2.3 COMPONENTS

A. Manhole Steps: Formed polypropylene rungs; ¾-inch diameter.

B. Foundation Slab: Cast-in-place concrete of size shown in Drawings, leveled top surface.

C. Casting Seal: Butyl Mastic

2.4 CONFIGURATION

A. Manholes shall be manufactured with Type II, sulfide resistant concrete having a minimum 28-day compressive strength of 4,000 psi.

B. Minimum wall thickness of the riser sections shall be as follows:

48" I.D. – 5" 60" I.D. – 6" 72" I.D. – 7"

C. Cone sections shall have a 5" minimum wall thickness at the bottom and an 8" thickness at the top.

D. Joints between manhole sections will be made with offset joints with rubber gaskets or preformed butyl sealants.

E. Two lift holes shall be cast into each manhole section.

F. Openings shall be provided in the manhole sections at the locations and elevations shown on the Drawings.

G. Flexible manhole sleeves, or boots, shall be used to connect each pipe to the manhole. Sleeve to be made of EPDM rubber with bands and clamps made of 304 stainless steel. Sleeve shall be as manufactured by KOR-N-SEAL or equal.

H. Steps: ¾ inch diameter reinforced plastic, 12 inches wide, 16 inches on center vertically, set into structure wall with a minimum embedment of 3-3/8 inches.

2.5 ACCESSORIES

A. Watertight Polyethylene Manhole Insert:
1. Manufacturers:
   a. Parsons Environmental Products.
   b. No Flow Inflow.

Substitutions: City of Gadsden Division 105- General Conditions

B. External Seal Wrap
1. Each manhole joint shall be sealed with an external rubber sleeve made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 30 mils.
2. The back side of each unit shall be coated with a non-hardening butyl rubber mastic with a minimum thickness of 187 mils.
3. The adjustment rings and the castings shall also be sealed with an external rubber seal wrap made of EPDM rubber with a minimum thickness of 65 mils.
4. Manufacturers:
   a. Sealing Systems, Inc (Infi-Shield)
   b. Canusa-CPS (Wrapidseal).
   c. Concrete Sealants, Inc. (ConSeal).
   d. Substitutions: Section 01600 - Product Requirements.

2.6 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 31 05 16.

B. Backfill: Fill Type A2, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil as specified in Section 31 00 00

2.7 PILE SUPPORT SYSTEMS – Not Used

2.8 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.

C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION - GENERAL

A. Excavation and Backfill:
   1. Excavate for manholes and structures in accordance with Section 31 00 00 in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill [and placement of geotextile filter fabric where required.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
   3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Place foundation slab, trowel top surface level.

C. Install manholes and structures supported at proper grade and alignment on crushed stone bedding as shown on Drawings.

D. Where groundwater is encountered in excavation, install vertical pipe adjacent to manhole of sufficient diameter to allow monitoring of groundwater in trench. Place pipe above trench bottom to allow accurate groundwater level measurement. Upon completion of low pressure air testing of gravity sewer, remove pipe and backfill.

E. Backfill excavations for manholes and structures in accordance with Section 31 0000.

F. Place manhole plumb and level, to correct dimensions and elevations.

G. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

H. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast manholes and structures at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

C. Set precast manholes and structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 00 00 or on other support system shown on Drawings.

D. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Seal manhole joints with rubber external wrap.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Cut pipe to finish flush with interior of manhole or structure.

I. All pipe connections to manhole shall be installed using watertight sleeves as per 2.4G.

J. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

3.5 DOGHOUSE MANHOLE AND STRUCTURE INSTALLATION

A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.

B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with granular fill compacted to 95% dry density.

C. Prepare crushed stone bedding or other support system shown on Drawings, to receive foundation slab as specified for precast manholes and structures.

D. Install pre-cast concrete manhole around existing pipe in accordance with the appropriate paragraphs specified herein.

E. Seal manhole joints with rubber external wrap.

F. Grout pipe entrances in accordance with Section 03 30 00.

G. Perform connection to existing pipe between the hours of 9:00 a.m. and 4:00 p.m.

H. Block upstream flow at existing manhole or structure with expandable plug.

I. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.

J. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

3.6 SANITARY MANHOLE DROP CONNECTIONS

A. Construct drop connections into sanitary manholes in accordance with Drawings.

B. Concrete encase pipe drop connection to minimum of 2 feet outside of manhole.

C. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.

3.7 CASTINGS INSTALLATION

A. Set frames using precast concrete or polyethylene grade rings as indicated on Drawings. Concrete brick and mortar shall not be permitted.

B. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover.

C. Bolt frame to concrete cone section or grade ring and seal with mastic or rubber wrap.

3.8 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements.

B. Test cast-in-place concrete in accordance with Section 03 3000.

C. Test concrete manhole and structure sections in accordance with ASTM C497. As a minimum, each manhole shall be field tested, from invert to casting, for infiltration using a vacuum test at ten inches (10”) of mercury for sixty (60) seconds with less than a one inch reduction.

D. Vertical Adjustment of Existing Manholes and Structures:
1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

END OF SECTION

SECTION 33 0563

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes precast concrete utility structures:
1. Drainage system catch basins.
2. Drainage system inlets.
3. Drainage system junction boxes.
4. Drainage system sedimentation chambers.
5. Drainage system retention/diversion structures.
6. Sanitary sewer lift station pits.
7. Sanitary sewer lift station valve chambers.
8. Sanitary drain field dosing chambers.
9. Single cell box culverts.
10. Oil water separators.
11. Grease interceptors.
12. Valve pits.
13. End walls.
14. Pipe ends.
15. Frames and covers.
16. Access hatches.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Precast Concrete Utility Structures:
1. Basis of Measurement: By each complete structure.
2. Basis of Payment: Includes excavating, concrete foundation slab, concrete structure sections, cover frame and cover, to indicated depth, forming and sealing pipe inlets and outlets.

1.3 REFERENCES

A. American Association of State Highway Transportation Officials:
1. AASHTO M306 - Drainage Structure Castings.
2. AASHTO S99-HB - Standard Specifications for Highway Bridges.

B. American Concrete Institute:
1. ACI 318 - Building Code Requirements for Structural Concrete.
2. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
3. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
3. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
6. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
7. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
8. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
9. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
10. ASTM C33 - Standard Specification for Concrete Aggregates.
11. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
12. ASTM C150 - Standard Specification for Portland Cement.
13. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C192/C192M - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
15. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
16. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
17. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
18. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
19. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
20. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
21. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
22. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

D. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

E. National Precast Concrete Association:
1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

DESIGN REQUIREMENTS

F. Design structures for minimum loads in accordance with ASTM C857.
   1. Roof Live Load: ASTM C857, HS20-44 including impact load.
   2. Dead Loads: Actual weight of materials producing static load.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawings:
   1. Indicate structure locations, elevations, sections, equipment supports, piping, and conduit sizes and elevations of penetrations.
   2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings and concrete strength for each type, size and configuration.

C. Product Data:
   1. Submit data for frames and covers, steps, component construction, features, configuration and dimensions.

D. Design Data:
   1. Submit concrete mix design for each different mix.
   2. Submit design calculations for custom fabrications signed and sealed by professional engineer registered in the State of Alabama.

1.5 QUALITY ASSURANCE

A. Obtain precast concrete utility structures from single source.

B. Perform structural design in accordance with ACI 318.

C. Perform Work in accordance with NPCA Quality Control Manual for Precast Plants.

D. Conform to the following for material and fabrication requirements:
   1. Single Cell Box Culverts: ASTM C1433.
   2. Three Sided Structures: ASTM C1504.
   3. Other Structures: ASTM C913.

E. Perform welding in accordance with the following:
   1. Structural Steel: AWS D1.1.
   2. Reinforcing Steel: AWS D1.4.

1.6 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.

B. Installer: Company specializing in performing work of this section with minimum 5 years experience.

C. Design custom utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Alabama.

D. Welders: AWS qualified within previous 12 months.

1.7 DELIVERY, STORAGE AND HANDLING

A. City of Gadsden Division 105- General Conditions

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast structures. Lift structures from designated lifting points.

C. Do not deliver products until concrete has cured 14 days or attained minimum 80 percent of specified 28-day compressive strength.

D. Store precast concrete structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

E. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE UTILITY STRUCTURES

A. Precast Concrete Utility Structures: Reinforced precast concrete.

B. Foundation Slab: Cast-in-place or Precast concrete of type specified in Section 03 30 00, leveled top surface.

2.2 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C33, except gradation requirements do not apply.

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical Admixtures: ASTM C494.
1. Type A - Water Reducing.
2. Type B - Retarding.
3. Type C - Accelerating.
4. Type D - Water Reducing and Retarding.
5. Type E - Water Reducing and Accelerating.

C. Fly Ash: ASTM C618 Class F.

2.4 CONCRETE REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Reinforcing Wire:
1. Plain Wire: ASTM A82; unfinished.
2. Deformed Wire: ASTM A496 unfinished.

C. Welded Steel Wire Fabric:
1. Plain Wire: ASTM A185; unfinished.
2. Deformed Wire: ASTM A497; unfinished.

2.5 FRAMES AND COVERS

A. Manufacturers:
1. John Bouchard and Sons, Inc.
2. East Jordan Iron Works.
3. Neenah Foundry Co.

Substitutions: City of Gadsden Division 105- General Conditions

B. Product Description: Cast iron construction.
1. Lid: Machined flat bearing surface, removable lid, closed cover design; traffic load rated.
2. Grate: Bicycle Safe grate.
3. Nominal Lid or Grate Size: See Drawings.

2.6 ACCESS HATCHES

A. Manufacturers:
1. Thompson Fabricating Company
2. The Bilco Company.
3. U.S.F. Fabrication Inc.

Substitutions: City of Gadsden Division 105- General Conditions

B. Access Hatch: Aluminum welded construction; 6 x 4 feet in size; double door.
1. Cover: Diamond plate reinforced with structural stiffeners to support required loads.
2. Frame: Channel type; with integral seat to support cover stiffeners; anchor flange around frame perimeter.
3. Hinges: Stainless steel.
4. Lift Handle: Flush drop handle, non-removable type mounted in cover.
5. Lifting Mechanism: Stainless steel compression springs with automatic hold open and dead stop to retain cover in open position. Cover springs to prevent contact by personnel entering utility structure.
6. Latch Mechanism: Stainless steel lock with removable external handle and permanent internal release mechanism.
7. Hardware: Stainless steel.
8. Finish: Mill

2.7 ACCESSORIES

A. Steps: Formed steel reinforced polypropylene rungs.
   1. Diameter: 3/4 inch.
   2. Width: 12 inches.
   3. Spacing: 16 inches on center vertically.

B. Inserted and Embedded Items:
   1. Structural Steel Sections: ASTM A36/A36M; minimum 1.25 oz/sq ft galvanized coating.

C. Joint Sealants and Joint Gaskets:
   1. Gasket Joints for Circular Concrete Pipe: ASTM C443; standard rubber gaskets.
   2. External Sealing Bands: ASTM C877; Type I rubber and mastic bands.
   3. Preformed Joint Sealants for Concrete Pipe and Box Sections: ASTM C990.

D. Pipe Entry Connectors: Modular, mechanical seal consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

E. Grout:
   1. Cement Grout: Portland cement, sand and water mixture with stiff consistency to suit intended purpose.
   2. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

F. Bituminous Coating:
   1. Required at all locations where aluminum surfaces are in contact with concrete.

2.8 CONCRETE MIX

A. Concrete mix design for pre-cast concrete structures shall be as recommended by the manufacturer.

2.9 FABRICATION

A. Fabricate precast concrete utility structures in accordance with ACI 318 and NPCA Quality Control Manual for Precast Plants.

B. Fabricate precast concrete utility structures to size, configuration and openings as indicated on Drawings.

C. Construct forms to provide uniform precast concrete units with consistent dimensions.

D. Clean forms after each use.

E. Install reinforcing by tying or welding to form rigid assemblies. Position reinforcing to maintain minimum 1-inch cover. Secure reinforcement to prevent displacement when placing concrete.

F. Position and secure embedded items to prevent displacement when placing concrete.

G. Deposit concrete in forms. Consolidate concrete without segregating aggregate.

H. Provide initial curing by retaining moisture using one of the following methods:
   1. Cover with polyethylene sheets.
   2. Cover with burlap or other absorptive material and keep continually moist.
   3. Apply curing compound in accordance with manufacturer's instructions.

I. Provide final curing in accordance with manufacturer's standard.

J. Remove forms without damaging concrete.

2.10 CONCRETE FINISHES

A. Formed Surfaces Not Exposed to View: As formed.

B. Unformed Surfaces: Finish with vibrating screed or hand float.
   1. Permitted: Color variations, minor indentations, chips, and spalls.
   2. Not Permitted: Major imperfections, honeycomb, or other defects.

C. Exposed to View Finishes: Troweled.

2.11 SOURCE QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Perform the following tests for each 150 cy of concrete placed, with minimum one set of tests each week.
   1. Slump: ASTM C143/C143M.
   2. Compressive Strength: ASTM C31/C31M, ASTM C192/C192M and ASTM C39/C39M.
   3. Air Content: ASTM C231 or ASTM C173.
   4. Unit Weight: ASTM C138.

C. Visually inspect completed precast structures for defects.
   1. Repair defects affecting exposed to view surfaces to achieve uniform appearance.
   2. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
   3. Repair major defects only when permitted by Engineer.

D. Make test results available to Engineer upon request.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify correct size and elevation of excavation.

D. Verify subgrade and bedding is properly prepared, compacted and ready to receive Work of this section.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Install underground precast utility structures in accordance with ASTM C891.

B. Lift precast concrete structures at lifting points designated by manufacturer.

C. When lowering structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

D. Install precast concrete base to elevation and alignment indicated on Drawings.

E. Install precast concrete utility structures to elevation and alignment indicated on Drawings.

F. Assemble multi-section structures by lowering each section into excavation.
   1. Clean joint surfaces.
   2. Install watertight joint seals in accordance with manufacturer's instructions using external sealing bands.

G. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with grout.

H. Connect pipe to structure and seal watertight. Cut pipe flush with interior of structure.

I. Grout base to achieve slope to exit piping. Trowel smooth. Contour as indicated on Drawings.

J. Paint interior with 2 coats of bituminous interior coating at rate of 120 square feet per gallon for each coat.

K. Set frame and cover or access hatch level without tipping, to elevations indicated on Drawings.
   1. Set cover 2 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
   2. Connect drain from access hatch frame to storm drainage system.

L. Touch up damaged galvanized coatings.

M. Backfill excavations for structures in accordance with Section 31 00 00.

END OF SECTION

SECTION 33 1412

HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Scope – This section specifies high density polyethylene pipe (HDPE) and fittings for water and sewer utility use as indicated on the Plans, and as specified herein.
   1. Furnish, install, and test HDPE pipe as indicated and specified in this section and the Plans.
   2. The primary installation method is burial. The means and methods, including the testing for acceptance shall conform to all applicable standards as noted herein with the intention of providing a leak-free system to the owner.

B. Related Sections:
   1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 REFERENCES

A. ANSI/AWWA www.awwa.org
   1. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76mm) for Water Service.
   2. ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 IN. (1,600 mm), for Water Distribution and Transmission.
   3. ANSI/AWWA C651 Standard for Disinfecting Water Mains.
   4. AWWA M55 Manual of Water Supply Practices, PE Pipe – Design and Installation

B. Plastics Pipe Institute, PPI www.plasticpipe.org
   1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
   2. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
   3. PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
   4. PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
   5. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and and Industrial Projects (2009)
   6. PPI TR-46 Guidance for Field Hydrostatic Testing of High Density Polyethylene Pressure Pipelines

C. NSF www.nsf.org
   1. NSF / ANSI 61 Drinking Water System Components – Health Effects

D. ASTM www.astm.org
   1. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
   2. ASTM F905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints

3. ASTM F 1055 Standard Specification for Electofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
4. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
5. ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
6. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
7. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
8. ASTM F 2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
9. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR- PR) Based on Controlled Inside Diameter
10. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
11. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
12. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
13. ASTM 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
14. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
15. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
16. ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.3 SYSTEM DESIGN PARAMETERS

A. The polyethylene system working pressure rating accommodates the normal operating pressure and the repetitive surges. The pressure rating applies at 80^{o}F or less.

B. Per AWWA C901 and C906, the repetitive surge pressure allowance is equal to the pressure class of the pipe. Allowable total pressure during recurring surge conditions equals 1.5 times the pipe's pressure class. Allowable total pressure during occasional surge conditions equals 2.0 times the pipe's pressure class.

C. Table 1 gives the Pressure Class per AWWA C901, pressure rating and allowable total pressure during recurring and occasional surge for PE 4710 pipe at 80^{o}F or less.

Table 1. Pressure Class per AWWA C901 for PE 4710 at 80°F or less

Pipe Dimension Ration (DR)	Pressure Class	Pressure Rating	Allowable Total Pressure During Recurring Surge	Allowable Total Pressure During Occasional Surge
DR 9	250 psi	250 psi	375 psi	500 psi
DR 11	200 psi	200 psi	300 psi	400 psi
DR 13.5	160 psi	160 psi	240 psi	320 psi
DR 17	125 psi	125 psi	185 psi	250 psi
DR 21	100 psi	100 psi	150 psi	200 psi

1.4 SUBMITTALS

A. Quality Assurance / Control Submittals
1. Affirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards. (The specifier can also ask for various test results to be supplied that are done according to the standards)
2. Manufacturers recommended fusion procedures for the products.
3. Fusion Technician Qualifications: Contractor shall submit to Engineer, prior to start of work, copies of current certification card for each fuser to be used on the Project.

1.5 DELIVERY – STORAGE - HANDLING

A. Handle the pipe in accordance with the PPI *Handbook of Polyethylene Pipe (2nd Edition), Chapter 2* using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.

B. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

1.6 DATA LOGGER

A. Contractor shall utilize a data logger to record and document all parameters of each fusion joint including butt fuse and sidewall fuse.

B. Data logger shall record pipe material, DR rating, heat plate temperature, fusion time, cooling time, climatic conditions, fusion machine used, operator, project name, date, time, take pictures before, during and after fusion, and record GPS coordinates of each fusion.

C. All data from the data logger shall be uploaded to a secure server. Owner and Engineer shall have full access to all data recorded.

1.7 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 HDPE PIPE, 3 INCH AND SMALLER

A. Polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE 4710. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C for PE 4710. In addition, the pipe shall be listed as meeting NSF-61.

B. The pipe shall meet the requirements of AWWA C901.

C. HDPE pipe shall be rated for use at a pressure class as shown in the Plans and as listed on the Bid Schedule. The outside diameter of the pipe shall be based upon the IPS sizing system.

D. Unless otherwise specified all HDPE pipe shall be PE 4710.

E. Fittings

1. Butt Fusion Fittings
   a. Fittings shall be made of either PE 4710, with a minimum Cell Classification as noted in 2A.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.
   b. Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.
2. Electrofusion Fittings – Fittings shall be PE 4710, with a minimum Cell Classification as noted in 2A.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
3. Flanges and Mechanical Joint Adapters (MJ Adapters)
   a. Flanges and Mechanical Joint Adapters (MJ Adapters) – Flanges and Mechanical Joint Adapters shall be PE 4710, with a minimum Cell Classification as noted in 2A.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206.

b. Van-Stone style, metallic (including stainless steel), convoluted or flat- plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note #38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure- class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back- up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.

F. Service Connections

1. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.
2. For electrofusion saddles with threaded outlet the size of the outlet shall be ¾ inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part 2.2 B. Electrofusion Fittings.
3. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼" of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide
¼ inch of area beyond the saddles are not acceptable.
4. Tapping tees shall be made to ASTM D3261 or D2683.
5. Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer's instructions.

2.2 PIPE AND FITTING IDENTIFICATION

A. The pipe shall be marked in accordance with the standards to which it is manufactured.

B. Color identification by the use of stripes on pipe to identify pipe service shall be required. Stripes or colored exterior pipe product shall be blue for potable water.

C. Tracing wire shall be placed parallel and above, but separate from the pipe and shall be 10 AWG or engineer approved equal.

D. Marking tape shall be approved by the engineer and placed between 6 and 12 inches above the crown of pipe.

2.3 HDPE PIPE, 4 INCH AND LARGER

A. Polyethylene pipe shall be made from HDPE material having a material designation code of PE 4710 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE345464C. In addition, the material shall have a minimum cell classification of PE345464C. In addition, the material shall be listed as meeting NSF-61.

B. The pipe and fittings shall meet the requirements of AWWA C906.

C. HDPE pipe shall be rated for use at a pressure class as shown in the Plans and as listed on the Bid Schedule. The outside diameter of the pipe shall be based upon the IPS sizing system.

D. Unless otherwise specified all HDPE pipe shall be PE 4710.

E. Fittings

1. Butt Fusion Fittings
   a. Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2B.01A Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All fittings shall meet the requirements of AWWA C906.
   b. Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.
2. Electrofusion Fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2B.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. Markings shall be according to ASTM F 1055.
3. Flanges and Mechanical Joint Adapters (MJ Adapters)
   a. Flanges and Mechanical Joint Adapters shall have a material designation code of PE 4710 or higher and a minimum Cell Classification as noted in 2B.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206.
   b. Van-Stone style, metallic (including stainless steel), convoluted or flat- plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125,

or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure- class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back- up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.

F. Service Connections

1. Service Connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.
2. For electrofusion saddles with threaded outlet the size of the outlet shall be ¾ inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in 2.2 B. Electrofusion Fittings.
3. For sidewall fusion saddles the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼" of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼ inch of area beyond the saddle are not acceptable.
4. Tapping tees shall be made to ASTM D3261 or D2683.
5. Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer's instructions.

2.4 PIPE AND FITTING IDENTIFICATION

A. The pipe shall be marked in accordance with the standards to which it is manufactured.

B. Color identification by the use of stripes on pipe to identify pipe service shall be required. Stripes or colored exterior pipe product shall be blue for potable water, or green for wastewater/sewage, or purple (lavender) for reclaimed water.

C. Tracing wire shall be placed parallel and above, but separate from the pipe and shall be 10 AWG or engineer approved equal.

D. Marking tape shall be approved by the engineer and placed between 6 and 12 inches above the crown of pipe.

PART 3 EXECUTION

3.1 JOINING METHODS

A. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting

manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

B. Saddle fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or TR-41 or the fitting manufacturer's recommendations and PPI TR-41. Saddle fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past year on the equipment to be utilized on this project. (Saddle fusion is used to fuse branch saddles, tapping tees, and other HDPE constructs onto the wall of the main pipe) (ASTM F905).

C. Socket Fusion: Molded socket fusion fittings are only to be used for joining of HDPE pipe from ½ inch to 2 inch in size. Socket fusion shall be done in accordance with ASTM F 2620 or the fitting manufacturer's recommendations. Socket fusion is the process of fusing pipe to pipe, or pipe to fitting by the use of a male and female end that are heated simultaneously, and pressed together so the outside wall of the male end is fused to the inside wall of the female end. Qualification of the fusion technician shall be demonstrated by evidence of socket fusion training within the past year on the equipment to be utilized on this project. (Socket fusion is not widely used, and the specifier may decide to prohibit its use)

D. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion require3s an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting, that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project.

E. Mechanical:
   1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.
   2. Mechanical connections on small pipe under 3" are available to connect HDPE pipe to other HDPE pipe, or fittings, or to a transition to another material. The use of stab-fit style couplings is allowed, along with the use of metallic couplings of brass and other materials. All mechanical and compression fittings shall be recommended by the manufacturer for potable water use. When a compression type or mechanical type of coupling is used, the use of a rigid tubular insert stiffener inside the end of the pipe is recommended.
   3. Mechanical couplings that wrap around the pipe and act as saddles are made by several manufacturers specifically for HDPE pipe. All such saddles, tapping saddles, couplings, clamps etc. shall be recommended by the manufacturer as being designed for use with HDPE pipe at the pressure class listed in this section.
   4. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
   5. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training

within the past year. This training shall be on the equipment and pipe components to be utilized for this project.

F. Joint Recording – The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded or by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report.

3.2 INSTALLATION

A. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.

B. Pipe embedment – Embedment material should be Class I, Class II, or Class III, materials as defined by ASTM D-2321 Section 6. The use of Class IV and Class V materials is not recommended; however it may be used only with the approval of the engineer and appropriate compaction.

C. Bedding: Pipe bedding shall be in conformance with ASTM D2321 Section 8. Compaction rates should be as specified in ASTM D2321. Deviations shall be approved by the engineer.

3.3 TESTING

A. Testing shall be as outlined in ASTM F2164.

B. The maximum test pressure should be measured at the lowest elevation in the test section. For pressure piping systems that include polyethylene pipe or fittings, the maximum permissible test pressure is the lower of:

1. 150% of the PE pipe system's design pressure rating for the application and application service temperature, provided that all components in the test section are rated for the test pressure.
2. The pressure rating of the lowest pressure rated component in the test section. Lower pressure-rated components or devices may include pipe or fittings made from other plastics or metals, appurtenances such as valves, hydrants, regulators, and pressure relief devices, or some types of mechanical connections such as lower pressure-rated compression couplings or flanges with lower pressure-rated back- up rings.

C. Test Temperature: The pipe should be allowed to thermally stabilize and equalize before pressurizing the pipe to test pressure. All thermoplastic pipes have reduced strength at elevated temperature. Test pressure must be reduced when the test section is at elevated temperature either from service conditions or from environmental conditions such as being warmed by the sun. Multiply the test pressure by the Table 1 multiplier to determine the allowable elevated temperature test pressure.

Table 1 Elevated Temperature Multiplier

Test Section Temperature °F (°C)	≤80 (≤ 27)†	≤90 (≤ 32)	≤100 (≤ 38)	≤110 (≤ 43)	≤120 (≤ 49)	≤130 (≤ 54)	≤140 (≤ 60)‡
Multiplier	1.0	0.9	0.8	0.8	0.7	0.7	0.6

† Use the 80°F (27°C) multiplier for 80°F (27°C) and lower temperatures.
‡ The maximum service temperature for PE pressure piping is 140°F (60°C).

D. Test Duration:
   1. When testing at pressures above the system design pressure up to 150% of the system design pressure, the maximum test duration is eight (8) hours including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize the test section. If the test is not completed due to leakage, equipment failure, or for any other reason, depressurize the test section completely, and allow it to relax for at least eight (8) hours before pressurizing the test section again. CAUTION – Testing at excessive pressures or for excessive time may damage the piping system.
   2. When testing at the system design pressure or less, test duration including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize should be limited to a practical time period given that the test section is not to be left unsupervised at any time during leak testing.

E. Filling: Fill the restrained test section completely with water. After filling, allow time for the system to reach thermal equilibrium and allow for any dissolved air to exit the system air vents. No air shall be trapped in the test section.

F. Initial Expansion Phase
   1. Gradually pressurize the test section to test pressure and add make-up water as necessary to maintain the maximum test pressure for four (4) hours. During the initial expansion phase, polyethylene pipe will expand slightly due to elasticity and Poisson effects.
   2. Additional test liquid will be required to maintain pressure.
   3. If test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing and correct them before continuing.

G. Test Phase
   1. Immediately following the initial expansion phase, reduce test pressure by 10 psi and stop adding test liquid. Monitor the pressure for 1 hour.
   2. If no visual leakage is observed and test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.

H. Depressurization: Depressurize the test section by reducing pressure or releasing test liquid at a controlled rate. Sudden depressurization can cause water hammer.

I. Low Pressure Air Testing of Gravity Flow Systems: For gravity flow and low or intermittent pressure applications such as sewer and odor control, leak testing in accordance with ASTM F1417 is required.

END OF SECTION

SECTION 33 1416

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water distribution piping.
2. Water service connections.
3. Valves and Boxes.
4. Fire Hydrants.
5. Master Water Meter.
6. Positive displacement meters.
7. Underground pipe markers.
8. Aboveground pipe markers.
9. Precast concrete vault.
10. Meter Boxes.
11. Pipe Supports and Anchoring.
12. Pile Support Systems.
13. Concrete Encasement and Cradles.
14. Mechanical Join Restraint.
15. Flange Adaptor.
16. Bolt-through Adaptor.
17. Restrained Coupling.
18. Bedding and cover materials.
19. Finishing - Steel.
20. Adjustable Roller Hanger

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Water Distribution Piping:
1. Basis of Measurement: Linear Foot.
2. Basis of Payment: Includes all labor and equipment associated with excavating (including rock excavation), installation water main at locations shown on Plans, installation of detector wire and tape, bedding, backfill with excavated material, concrete for thrust blocks, mechanical restraints, restrained coupling, compaction, supply and installation of blue pipeline markers as requested by Engineer/Owner, disinfection and testing, cleanup, traffic control, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist. Payment shall be per linear foot of water main laid, based on the size, material, special coating (if required), and joint type shown on the Plans and reflected on the Bid Form.

B. Wet Connection:
1. Basis of Measurement: Per Each.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation unless otherwise stated), coordination of service outages, isolation of system by closing valves, cutting of existing pipe, dewatering, removal of cut pipe, any necessary piping/fittings to make the connection, bedding, native soil backfill, testing, cleanup, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist.

C. Compact Ductile Iron Fittings:
1. Basis of Measurement: Per Pounds or Tons as indicated on the Bid Form.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), installation of ductile iron fittings, installation of transition fittings, "mega-lug" retainer glands, concrete thrust blocks, backfill, compaction, testing, cleanup, and all related items.

D. Master Meters:
1. Basis of Measurement: Per Each.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation, master meter, meter box/vault, testing, backfill, cleanup and all related items.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A242 – Standard Specification for High-Strength Low-Alloy Structural Steel.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
5. ASTM A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
8. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
9. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure- Rated Pipe (SDR Series).

10. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
13. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:
1. ANSI/AWWA C104/A21.4 - Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105/A21.5 - Standard for Polyethylene Encasement for Ductile- Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
4. ANSI/AWWA C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. ANSI/AWWA C116/A21.16 – Standard for Protective Fusion-bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
7. ANSI/AWWA C150/A21.50 - Standard for the Thickness Design of Ductile-Iron Pipe.
8. ANSI/AWWA C151/A21.51 - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
9. ANSI/AWWA C153/A21.53 - Standard for Ductile-Iron Compact Fittings for Water Service.
10. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
11. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
12. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
13. AWWA C206 - Field Welding of Steel Water Pipe.
14. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
15. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
16. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
17. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
18. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
19. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.
20. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
21. AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
22. AWWA C606 - Grooved and Shouldered Joints.
23. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
24. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.

25. AWWA C702 - Cold-Water Meters - Compound Type.
26. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
27. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm Through 300 mm), for Water Distribution.
28. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
29. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
30. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

E. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Agency:
1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawings: Indicate piping layout, including piping specialties.

C. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

D. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves, hydrants, and accessories provided meet or exceed AWWA Standards and specification requirements.

E. Fusion Technician Qualification: HDPE or Fusible PVC pipe manufacturer or pipe supplier qualification to butt-fuse pipe products.

1.5 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 DELIVERY, STORAGE, AND HANDLING

A. City of Gadsden Division 105- General Conditions

B. Deliver and store materials in shipping containers with labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Store polyethylene and PVC materials out of direct sunlight.

F. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 MAINTENANCE MATERIALS

A. Furnish one valve tee wrench and one fire hydrant wrench to Owner.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION PIPING

A. Ductile Iron Pipe: AWWA C151.
   1. Coatings and Lining:
      a. Outside: Bituminous coating, 1-mil minimum.
         1) Zinc outside coating if indicated in the Plans and/or Bid Form. ISO 8179-1
      b. Inside: Cement-mortar lining with Sealcoat, ANSI/AWWA C104/A21.4.
         1) Cement-mortar, double thickness if indicated in the Plans and/or Bid Form.
   2. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover. Pressure Classification as required on drawings for normal installation. Class 56 for pipe installation on river channel bottom.
   3. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
      a. Coating and Lining:
         1) Bituminous Coating: AWWA C110.
         2) Cement Mortar Lining: AWWA C104, double thickness.
         3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.

4. Joints:
   a. Mechanical and Push-On Joints: AWWA C111.
   b. Flanged Joints: AWWA C115.
   c. Restrained Joints: Refer to Section 2.14.
   d. Gaskets: Manufacturer's standard for push-on joint pipe. Refer to Section 2.15.
5. Encasement: AWWA C105 polyethylene encasement, 10 mil minimum thickness.

B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, Pressure Class 200:
1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
   a. Coating and Lining:
      1) Bituminous Coating: AWWA C110.
      2) Cement Mortar Lining: AWWA C104, double thickness.
      3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.
2. Joints:
   a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.

C. Polyvinyl Chloride (PVC): ASTM D2241, SDR-21 for 200 psig rating:
1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
   a. Coating and Lining:
      1) Bituminous Coating: AWWA C110.
      2) Cement Mortar Lining: AWWA C104, double thickness.
      3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.
2. Joints:
   a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
   b. Butt-fusion, per pipe supplier's written instructions and qualified fusion technician.

D. Fusible PVC: (Not Used)

E. High Density Polyethylene (HDPE): Refer to Section 33 14 12

F. Steel Pipe: AWWA C200 Fabricated Pipe, minimum wall thickness 0.375 inches for pipe diameters up to 8 inches and 0.50 inches for pipe diameters greater than 8 inches.
1. Fittings and Special Sections: AWWA C208.
2. Flanges: AWWA C207 slip-on.
3. Field Welding Materials:
   a. Pipe: AWWA C206.
   b. Joints: AWWA C205.
4. Interior Cement Mortar Lining: AWWA C205.
5. Buried Steel Pipe Exterior Lining:
   a. AWWA C213, fusion-bonded epoxy coating.

2.2 WATER SERVICE CONNECTIONS

A. Furnish materials and install in conformance with Section 33 14 17.

2.3 VALVES AND BOXES

A. Furnish materials and install in conformance with Section 33 14 19 - 1.

2.4 FIRE HYDRANTS

A. Furnish materials and install in conformance with Section 33 14 19 - 2.

2.5 MASTER WATER METER

A. Manufacturers:
1. Neptune HP Turbine
2. Badger Meter Turbo Series

Substitutions: City of Gadsden Division 105 - General Conditions

B. Water meters: Inline horizontal-axis type. AWWA Class II meeting NSF/ANSI 61 and NSF/ANSI 372 requirements.
1. Operating flow range: 100% ± 1.5% based on meter size.
2. Maximum Operating Temperature: 120° F (49° C).
3. Accuracy: Within 1.5%
4. 150 psig maximum working pressure or as reflected on the Plans.
5. Strainer: Integral or flanged in-line.
6. Straightening Vane: Directly upstream.
7. Housing and Head Material: Lead-free allow
8. Flanges: U.S. ANSI B16.1/AWWA Class 125
9. Register shall be in gallons unless stated elsewhere.
10. Encoder: If specified, meter shall be equipped with encoder remote registers per AWWA C707 and meet all AWWA C701 performance standards.
11. Meter size: As Shown on Plans or the Bid Form.

2.6 POSITIVE DISPLACEMENT METERS

A. Furnish materials and install in conformance with Section 33 14 17.

2.7 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed with "Water Service" in large letters, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire (for non-metallic pipe): No. 12 gauge copper clad steel (CCS) reinforced with blue plastic covering, imprinted.

2.8 ABOVEGROUND PIPE MARKERS

A. Manufacturer:
1. Markers to Locations: Furnish at valves, casing ends, major bends, and other locations requested by Engineer or Owner.

B. Marker: Install according to manufacturer’s instructions. Color and markings shall be blue unless

otherwise indicated.

2.9 PRECAST CONCRETE VAULTS

A. Precast Concrete Vaults: Refer to Plans; shall be approved by Gadsden Wastewater & Sewer Board.

2.10 METER BOXES

A. Furnish materials in conformance with Section 33 14 17.

2.11 PIPE SUPPORTS AND ANCHORING

A. Metal for pipe support brackets: Structural steel, thoroughly coated with epoxy paint.

B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24.

2.12 PILE SUPPORT SYSTEMS (Not used)

2.13 CONCRETE ENCASEMENT AND CRADLES

A. Concrete: Conforming to Section 32 16 00, 4,000 psi 28-day reinforced concrete, rough troweled finish.

B. Concrete Reinforcement: Conform to Section 32 16 10.

2.14 STEEL CASING AND TUNNER LINER

A. Refer to Section 33 05 07 – Casing Pipe and Tunnel Liner.

2.15 JOINT RESTRAINT

A. Type I: Mechanical Joint Restraint
   1. Restraint devices for nominal pipe sizes 3" – 36" shall consist of multiple gripping wedges incorporated into a retainer gland meeting the requirements of ANSI/AWWA C111/A21.11, except for HDPE pipe.
   2. The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
   3. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron.
   4. Mechanical joint restraint shall be as follows:
      a. Series 2000PV by EBAA Iron, Inc. or equal for connecting PVC to mechanical joint fittings.

b. Series 1100 by EBAA Iron, Inc. or equal for connecting ductile iron pipe to mechanical joint fittings.

5. HDPE shall be fully restrained with fused-on flange adaptors, MJ adaptors, or other approved method or fitting. All recommendations and instructions for fitting from manufacturer shall be followed. No gripper-style restraints will be allowed.

6. HDPE connections shall be longitudinally restrained per the design by restrained fittings, anchor blocks, or other approved method.

B. Type II: Restrained Joint Pipe

1. Restrained Joint Pipe: AWWA C111.
2. Flexible restrained push-on type equivalent to “TR Flex” as manufactured by U.S. Pipe, or “Flex-Ring” as manufactured by American Cast Iron Pipe Company.
3. Restrained Joint Pipe shall be stored, installed, and tested in accordance with manufacturer’s instructions.

C. Type III: Restraining Gaskets

1. Restraining Gaskets: ANSI/AWWA C111/A21.11
2. Push on joint pipe specified with restraining gaskets shall incorporate gaskets equivalent to “Field-Lok 350 Gaskets” as manufactured by U.S. Pipe, or “Fast- Grip Gaskets” as manufactured by American Cast Iron Pipe Company.
3. Restraining Gaskets shall not be used at pipe end terminations.
4. Restraining Gaskets shall be stored, installed, and tested in accordance with manufacturer’s instructions.

2.16 FLANGE ADAPTOR

A. Flange adaptors may be used in lieu of threaded or welded flanges of plain end ductile pipe where allowed by the Engineer. These shall not be used with HDPE.

B. The restraints shall be manufactured of ductile iron conforming to ASTM A536.

C. The bolt circles and bolt holes shall conform to ANSI/AWWA C110/A21.10.

D. The restraint shall be Series 1000-EZ Flange as manufactured by EBAA Iron, Inc. or equal.

2.17 BOLT-THROUGH ADAPTOR

A. A bolt-through mechanical adaptor may be used or required in lieu of standard flange adaptors. These shall not be used with HDPE.

B. The restraints shall be manufactured of ductile iron conforming to ASTM A536.

C. The bolt circles and bolt holes shall conform to ANSI/AWWA C110/A21.11 and ASTM A242.

D. The adaptor shall be the “Foster” adaptor as manufactured by Infact Corporation or equal.

2.18 RESTRAINED COUPLING

A. Restrained couplings are used for joining and restraining two plain end pipes of the same or dissimilar materials.

B. Coupling shall be capable of being used on ductile iron, steel, PVC or HDPE pipe.

C. Coupling shall be constructed of ASTM A536 ductile iron and designed with a 2:1 safety factor.

D. Internal pipe wall stiffeners must be used when restraining HDPE.

E. The restraint mechanism shall incorporate a plurality of individually actuating gripping surfaces to maximize restraint capability and have torque limiting twist off nuts to insure proper actuating of the restraint devices.

F. The restraint devices shall be coated using fusion bonded epoxy approved for potable water contact.

G. The coupling sleeve internal surface (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

H. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

I. The restrained joining system shall meet the applicable requirements of AWWA C219, ANSI/AWWA C111/A21.11, and ASTM D2000.

J. The restrained coupling system shall be Series 3800 manufactured by EBAA Iron, Inc. or and approved equal.

2.19 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 31 05 16.

B. Cover: Fill Type as specified in Section 31 00 00 and the Plans.

C. Soil Backfill from Above Pipe to Finish Grade: Soil as specified in Section 31 00 00.

2.20 ACCESSORIES

A. Concrete for Thrust Restraints: Conform to Section 32 16 00.

B. Steel rods, bolts, lugs and brackets: ASTM A36/A36M or ASTM A307 carbon steel.

C. Protective Coating: Bituminous coating.

2.21 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

2.22 ADJUSTABLE ROLLER HANGER

A. Material: carbon steel axle with cast iron roller and socket ends.

B. Finish: electro-galvanized.

C. Service: designed for the suspension of pipe where longitudinal movement may occur due to expansion/contraction. Vertical adjustment is required.

D. Rods shall be installed into existing concrete bridge deck according to manufacturer's recommendations. Wedge type or epoxy type anchors shall be used to attach the rods to the bridge deck. Anchors shall be capable of supporting four (4) times the dead load of the pipe plus the water.

E. Each hanger shall have a lower and upper roller, fully adjustable.

F. Manufacturer:
1. Empire Industries, Inc.
2. Cooper B-Line
3. National Pipe Hanger Corporation
4. Substitutions: City of Gadsden Division 105 – General Conditions

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105 – General Conditions.

B. Verify existing utility water main size, location, and type is as indicated in the Plans.

C. Determine exact location and size of valves and hydrants from the Plans; obtain clarification and directions from Engineer prior to execution of work.

D. Verify invert elevations of existing work prior to excavation and installation of valves and fire hydrants.

E. All pipe and fittings must be inspected for damage from prior to installation. Any damaged piping must be replaced prior to installation.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe material being cut. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

D. Do not interrupt existing utilities without permission and without arranging to provide temporary utility services.
   1. Notify Owner and Engineer not less than two days in advance of proposed utility interruption.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 00 00 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated in the Plans.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

3.4 INSTALLATION - PIPE

A. Install pipe in accordance with AWWA C600. Trenching shall be in accordance with Section 31 23 16. Directional boring shall be in accordance with Section 02448 (Not Used)

B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated in the Plans.

C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

D. Maintain a minimum of 5 feet horizontal separation of water main from sewer piping.

E. Install ductile iron piping and fittings to AWWA C600.

F. Weld pipe in accordance with AWWA C206. Weld joints in accordance with AWWA C205.

G. Flanged Joints: Not to be used in underground installations except within structures.

H. Route pipe in straight line. Relay pipe that is out of alignment or grade.

I. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Engineer.

J. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

K. Prevent foreign material from entering pipe during placement.

L. Install pipe to allow for expansion and contraction without stressing pipe or joints.

M. Close pipe openings with watertight plugs during work stoppages.

N. Install access fittings to permit disinfection of water system performed under Section 33 01 10.

O. Establish elevations of buried piping with not less than three feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

P. Install plastic ribbon tape continuous 12 inches below final grade of surface.

Q. Install trace wire continuous 12 inches above any non-metallic pipe.

3.5 POLYETHYLENE ENCASEMENT

A. Encase piping in polyethylene where indicated on the Plans to prevent contact with surrounding backfill material or concrete thrust blocks.

B. Install in accordance with AWWA C105 and ASTM A674.

C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.6 THRUST RESTRAINT

A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks, Type I, II, or III restraint as indicated in the Plans. For concrete thrust blocks, pour against undisturbed earth. Locate thrust blocks such that pipe and fitting joints will be accessible for repair.

B. Install tie rods, clamps, set screw retainer glands, concrete anchors or restrained joints as indicated in the Plans. Protect metal restrained joint components against corrosion, when in contact with concrete, by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.

C. Install thrust blocks, tie rods, and type I or II joint restraint at dead ends of water main as shown in the Plans.

3.7 SERVICE CONNECTIONS

A. Install service connections in accordance with Section 33 14 17.

3.8 BACKFILLING

A. Backfill around sides and to top of pipe with cover fill in maximum lifts of 6 inches, tamp in place and compact in accordance with the Plans and Specifications. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.

B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.9 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 01 10.

3.10 FIELD QUALITY CONTROL

A. Refer to Section 33 14 12 for pressure test requirements for high density polyethylene (HDPE) piping.

B. In piping systems with multiple material types, HDPE piping must be pressure tested separately from ductile iron and/or PVC piping, unless otherwise indicated by the Engineer. Following an approved test for HDPE piping, the connections can be made, and the entire system can be tested as described below.

C. Pressure test system to the greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Repair leaks and re-test.

1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.

2. Provide all equipment required to perform leakage and hydrostatic pressure tests including water storage means, acceptable water volume measurement means, pumps, piping, calibrated pressure gauges, and chart recorder. Upon request of Engineer, provide certification of calibration of equipment acceptable to Engineer.

3. Test Pressure: The greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Obtain working pressure from Engineer.

4. Conduct hydrostatic test for at least six-hour duration.

5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, apply test pressure. At conclusion of tests, close and permanently seal resulting piping openings.

6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.

7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.

8. Maintain test pressure within +/- 5 psi throughout test duration by pumping additional water into the test segment. Accurately record test segment pressure continuously on chart recorder and volume of additional water supplied to test segment. Additional water supplied shall be designated as the leakage.

9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{SDvP}{C}$$

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches

p= average test pressure during leakage test, in pounds per square inch gauge C = 133,200

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION

SECTION 33 1417

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for domestic water service connections to buildings.
2. Corporation stop assembly.
3. Curb stop assembly.
4. Meter setting equipment.
5. Water meters.
6. Backflow preventers.
7. Underground pipe markers.
8. Bedding and cover materials.

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Service Connection:
1. Basis of Measurement: Each.
2. Basis of Payment: Includes all labor, material and equipment associated with excavation, tapping into new water main, new corporation stop, testing, backfill, cleanup and all related items. Payment shall be per Service Connection installed.

B. Service Reconnection:
1. Basis of Measurement: Each.
2. Basis of Payment: Includes all labor, material and equipment associated with excavation, tapping into new water main, new corporation stop, reconnection of customer's existing meter or plumbing line, testing, backfill, cleanup and all related items. Payment shall be per Service Reconnection installed.

C. Service Relocation:
1. Basis of Measurement: Each.
2. Basis of Payment: Includes all labor, material and equipment associated with excavation, connection to existing service line, relocation of existing meter, reconnection of customer's existing plumbing line, testing, backfill, cleanup and all related items. Payment shall be per Service Relocation completed.

D. Service Line:
1. Basis of Measurement: Linear Feet.
2. Basis of Payment: Includes all labor, material and equipment associated with installation of service line, backfill, compaction, disinfection, testing, cleanup, traffic control, erosion and sediment control, and all related items. Payment shall be per linear foot of service line, based on the size, material and installation type (open-cut or bored) shown on the Plans and/or reflected in the Bid Form.

E. Water Meter Assembly:
1. Basis of Measurement: Each.
2. Basis of Payment: Includes all labor, material and equipment associated with excavation, new curb stop, transition fittings, backflow preventer, meter box/vault, testing, backfill, cleanup and all related items. Payment shall be per Water Meter Assembly installed, based on the size and meter box type shown on the Plans and/or reflected in the Bid Form.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

D. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
5. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
6. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
8. ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
9. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

10. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
12. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
13. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 - Cold-Water Meters - Compound Type.
5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA C800 - Underground Service Line Valves and Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.4 SUBMITTALS

A. City of Gadsden Division 105 – General Conditions

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105 - General Conditions

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. City of Gadsden Division 105 - General Conditions

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Copper Tubing: ASTM B88, Type K, annealed:
1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
2. Joints: Compression connection or AWS A5.8, BCuP silver braze.

B. PVC Pipe: SDR-21 for 200 psig rating:
1. Fittings: SDR-21 PVC.
2. Joints: Compression. Solvent weld not acceptable.

C. Polyethylene Pipe: 200 psig pressure rating:
1. Fittings: AWWA C901, molded.
2. Joints: Compression.

D. Cross-linked Polyethylene (PEX) Tubing
1. Pipe to be manufactured using the high-pressure peroxide (Engel) method of cross-linking.
2. Pipe to have a co-extruded PE shield made from UV resistant high-density polyethylene, color blue.
3. Pipe to be Municipex as manufactured by REHAU or approved equal.
4. Tubing to be produced in SDR 9 copper tube sizes (CTS).
5. Fittings: Compression joint with stainless steel inserts.

2.2 CORPORATION STOP ASSEMBLY

A. Manufacturers:
1. Mueller Company.
2. Ford Meter Box Co.
3. A. Y. McDonald Manufacturing.

Substitutions: City of Gadsden Division 105 - General Conditions

B. Corporation Stops:
1. Manufactured in accordance with AWWA C 800 and ASTM B584.
   a. Any brass part of the fitting or valve which may possibly contact potable water shall be manufactured of “no-lead brass” constructed of either UNC Copper Alloy C 89520 or C 89833.
   b. Any brass part of the fitting which will not possibly contact potable water shall be manufactured of brass constructed of UNS Copper Alloy C 83600 meeting the requirements of ASTM B 62.
2. Inlet end threaded for tapping.
3. Outlet end suitable for service pipe material as recommended by the manufacturer.

C. Service Saddles:
1. Double strap type, designed to hold pressures in excess of pipe working pressure.

2.3 CURB STOP ASSEMBLY

A. Manufacturers:
1. Mueller Company.
2. Ford Meter Box Co.
3. A. Y. McDonald Manufacturing.

Substitutions: City of Gadsden Division 105 - General Conditions

B. Curb Stops:
1. Manufactured in accordance with AWWA C 800 and ASTM B584.
a. Any brass part of the fitting or valve which may possibly contact potable water shall be manufactured of “no-lead brass” constructed of either UNC Copper Alloy C 89520 or C 89833.
b. Any brass part of the fitting which will not possibly contact potable water shall be manufactured of brass constructed of UNS Copper Alloy C 83600 meeting the requirements of ASTM B 62.
2. Brass or red brass alloy body conforming to ASTM B62.
3. Ball valve type with padlock wings. End connections shall be appropriate for the service pipe material as recommended by the manufacturer

2.4 METER BOX

A. Precast Concrete Meter Box
1. 20”x 14”x 12” tall.
2. Concrete lid with cast iron reader.
3. Provide box extensions where required.

B. Plastic Meter Box
1. 16” x 10” x 18” tall.
2. Black with cast iron reader lid.
3. UV resistant.
4. Provide box extensions where required.

2.5 WATER METERS

A. Manufacturers:
1. Neptune.
2. Rockwell/Sensus.
3. Badger.

Substitutions: City of Gadsden Division 105 - General Conditions

B. Furnish materials in accordance with utility company standards.

C. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register.

D. Meter: Brass body with magnetic drive register.
   1. Service: Potable Water.
   2. Size: 5/8 inch x 3/4 inch or as indicated in the Plans and/or Bid Form.
   3. Unit of Measure: U.S. Gallons unless stated otherwise.
   4. Maximum Operating Pressure: 150 psi.
   5. Accuracy: 1/4 gpm @ 95% accuracy.
   6. Register Type: Direct or Remote Read.

2.6 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Mueller Company.
   2. Ford Meter Box Company.
   3. A. Y. McDonald Corporation.

   Substitutions: City of Gadsden Division 105 - General Conditions

B. Reduced Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Bronze body, with bronze internal parts and stainless steel springs.
   3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105 - General Conditions

B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

3.4 BEDDING

A. Excavate pipe trench in accordance with Section 31 00 00 for Work of this Section.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

C. Backfill around sides and to top of pipe in accordance with Section 31 00 00.

D. Place fill material in accordance with Section 31 00 00.

3.5 INSTALLATION - PIPE AND FITTINGS

A. Group piping with other site piping work whenever practical.

B. Route pipe in straight line.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Install access fittings to permit disinfection of water system.

E. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

F. Backfill trench in accordance with Section 31 00 00.

3.6 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on gravel bed and connect to inlet side of meter.

B. Center and plumb meter box over meter/curb stop assembly. Set box cover 1” above finished grade.

3.7 INSTALLATION - WATER METERS

A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet.

3.8 INSTALLATION - BACKFLOW PREVENTERS

A. Install backflow preventer on outlet side of each meter and in accordance with

manufacturer's instructions.

3.9 SERVICE CONNECTIONS

A. Install water service in accordance with utility company requirements with double check valve backflow preventer and pressure reducing valves where line pressure exceeds 80 psi.

B. Install water meter and backflow preventer in meter box located on site.

C. Flush and pressure test service line prior to connection of meter.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 01 10.

3.11 FIELD QUALITY CONTROL

A. Perform pressure test on water distribution system in accordance with Section 33 14 16.

END OF SECTION

SECTION 33 1419.1

VALVES FOR WATER AND SEWER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tapping Sleeve and Valves
2. Rubber Seated Butterfly Valves
3. Resilient Wedge Gate Valves
4. Eccentric Plug Valves
5. Swing Check Valves
6. Silent Check Valves
7. Insertion Valves
8. Air/Vacuum and Air Release Valves (Including Combination Types)
9. Pilot Operated Control Valves
10. Line Stopping
11. Accessories

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, Special Provisions and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C111 / A21.11-17 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
3. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray-Iron Fittings
4. AWWA C504 – Rubber-Seated Butterfly Valves
5. AWWA C508 – Swing Check Valves for Waterworks Service 2 in through 48 in
6. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
7. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
8. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water-Supply Service.
9. AWWA C517 – Resilient-Seated Cast Iron Eccentric Plug Valves
10. AWWA C530 – Pilot-Operated Control Valves
11. AWWA C541 – Hydraulic and Pneumatic Cylinder and Vane Type Actuators for Valves and Slide Gates
12. AWWA C542 – Electric Motor Actuators for Valves and Slide Gates
13. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
14. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Tapping Sleeve and Valve Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), installation of tapping sleeve and tapping valve, tap of existing line, removal of coupon, installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, testing, cleanup and restoration, and all related items.

B. Insertion Valves:
1. Basis of Measurement: Each, unless otherwise noted in the Plans.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), preparation of pipe at insertion site, and installation of the insertion valve assembly in accordance with the manufacturer's recommendations. Also includes installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, testing, cleanup and restoration, and all related items.

C. Water and Sewer Valves:
1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), connection and placement of valve, joint restraints, installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, compaction, cleanup and restoration, testing, and all related items.

D. Pilot Operated Control Valve Assemblies:
1. Basis of Measurement: Per Each or Lump Sum as indicated in the Proposal.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), valve vault, pilot operated control valve, associated internal and external piping as indicated in the plans, associated isolation valves as indicated in the Plans, drain piping as indicated in the Plans, related site work, general fill, compaction, cleanup and restoration, testing, start- up and commissioning services, and all related items.

E. Air Release and Air/Vacuum Valve Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), vault or manhole for access, air valve assembly, connection to main, connecting internal piping, isolation valves and

valves associated with accessories, drain piping as indicated in the Plans, fill as indicated in the plans, compaction ,cleanup and restoration, testing, and all related items.

F. Line Stopping Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), preparation of pipe at the location to be stopped off, and the installation of a temporary line stopping assembly in accordance with the

manufacturer's recommendations. Also includes a concrete line stop support (with pipe wrapped with visqueen or polywrap) according to the manufacturer's requirements, but with minimum dimensions of 2 feet from both ends and sides of the assembly and a depth from the spring line to 2 feet below the main.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer's Certificates: Submit Statement of Compliance and supporting data, from material suppliers stating that equipment and accessories provided meet or exceed AWWA Standards, NSF 61 certification, and specification requirements.

E. For Pilot-Operated Control Valves, provide schematic for pilot system operation.

F. For Insertion Valves or Line Stopping Assemblies, provide proposed procedures.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Record actual locations of valves and appurtenances.

C. Provide Operation and Maintenance Data for equipment indicating materials of construction, recommended maintenance activities and intervals, procedures for adjustments and troubleshooting, and sources for procurement of replacement parts.

D. For Pilot-Operated Control Valves, provide certification from manufacturer certifying installation of equipment in accordance with manufacturer's recommendations.

E. Where the Plans or Special Provisions require such, provide spare parts and maintenance materials to Owner.

1.6 QUALITY ASSURANCE

A. All Products for use in potable water systems shall be NSF 61 certified.

1.7 QUALIFICATIONS

A. Manufacturer:
   1. Utilize equipment and materials from Owner's standard list of acceptable manufacturers provided in the Special Provisions. If no such list is provided, utilize equipment and materials from list of acceptable manufacturers provided in these specifications.
   2. Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years

documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. City of Gadsden Division 105- General Conditions

B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.

C. Store products in accordance with manufacturer's written recommendations and instructions, and in areas protected from weather, moisture, or possible damage; do not store products directly on ground.

D. Handle products in accordance with manufacturer's written recommendations and instructions, and in such a manner as to prevent damage to interior or exterior mechanisms and surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. City of Gadsden Division 105- General Conditions

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 BASIC PROVISIONS FOR GATE, PLUG, BUTTERFLY, AND CHECK VALVES

A. End Connections: Mechanical joint, flanged, or wafer type as indicated in the Plans. If no such indication is provided, utilize mechanical joint for buried applications and flanged joints for exposed applications. Mechanical joints shall conform to AWWA C111 and shall be provided with retainer gland devices. Flanged joints shall conform to AWWA C115

ANSI B16.1 CL 150 unless noted otherwise and shall be provided with 316 stainless steel nuts and bolts.

B. Valve operators:
1. Provide gate, plug, and butterfly valves with open-left (counterclockwise) operation.
2. Provide gate valves with non-rising stems unless specifically stated otherwise in the plans.
3. Provide with 2-inch square operating nut for buried applications
4. Provide with handwheel operator for exposed applications with manual opening, or 2-inch square operating nut where electric or pneumatic actuator is utilized.
5. Provide side-mounted right-angle gear reducer on plug and butterfly valves 6-inch and larger, and on gate valves 16 inch and larger.

C. Coatings:
1. Provide fusion-bonded epoxy coating conforming to AWWA C116 on all valves for buried applications.
2. Provide coating in accordance with specification Section 09900 on all valves for exposed applications where this section is included. If Section is not included provide bituminous coating.

D. Provide flow direction arrow on all plug and check valves.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:
1. Stainless steel, full circumferential gasket, flanged outlet.
2. Manufacturers:
   a. Mueller.
   b. JCM Industries
   c. Ford Meter Box Co.

Substitutions: City of Gadsden Division 105- General Conditions

3. Outlet Flange Dimensions and Drilling: AWWA C207 Class D, ANSI 150lb. drilling and MSS SP-60.

B. Tapping Valves:
1. AWWA C515, resilient wedge with non-rising stem. Epoxy coated ductile iron body. Inlet flanges shall conform to ANSI B16.1, Class 150 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.
2. Manufacturers:
   a. Mueller
   b. M and H
   c. American Flow Control

Substitutions: City of Gadsden Division 105- General Conditions

2.3 RUBBER SEATED BUTTERFLY VALVES

A. Manufacturers:
1. Dezurik
2. Pratt
3. Valmatic

Substitutions: City of Gadsden Division 105- General Conditions

B. Valve body and disc constructed of ASTM A 536 cast iron (Grade 65-45-12). Valve disc shall be of the solid type.

C. Valve shaft constructed of ASTM A 276 Type 304 stainless steel.

D. Resilient seat constructed of Buna-N mated to Type 316 stainless steel body seat ring. Resilient seat shall be located on the valve disc and shall provide a continuous, uninterrupted seating surface.

E. All retaining hardware constructed of Type 316 stainless steel.

F. 150 psi maximum working pressure rating unless stated otherwise in the plans.

2.4 RESILIENT WEDGE GATE VALVES

A. Manufacturers:

1. Mueller
2. M and H Valve Co.
3. American Flow Control

Substitutions: City of Gadsden Division 105- General Conditions

B. Resilient Wedge Gate Valves: AWWA C515; ductile iron wedge and body.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Wedge: Ductile iron, completely encapsulated with resilient material.
   4. All internal parts shall be accessible without removing the body from the line.
   5. 250 psig maximum working pressure rating standard or 350 psi maximum working pressure rating where indicated on the plans.

2.5 ECCENTRIC PLUG VALVES

A. Manufacturers:
   1. DeZurik
   2. Mueller
   3. Pratt

Substitutions: City of Gadsden Division 105- General Conditions

B. Solid, one-piece plug constructed of cast iron conforming to ASTM A 126 Class B or ductile iron conforming to ASTM 536 Grade 65-45-12.

C. Cast iron body conforming to ASTM A 126 Class B with rectangular port. Permanently lubricated sleeve-type bearings constructed of Type 316 stainless steel.

D. Maximum working pressure rating of at least 175 psi for 12-inch and smaller valves, at least 150 psi for larger valves.

2.6 SWING CHECK VALVES

A. Manufacturers:
   1. Dezurik
   2. M and H Valve
   3. Mueller
   4. Pratt

Substitutions: City of Gadsden Division 105- General Conditions

B. Body, disc, and disc arm constructed of ASTM A 536 ductile iron (65-45-12).

C. Shaft shall be a single piece, constructed of Type 304 stainless steel.

D. Valve to be of single disc type with full flow passage.

E. Valve supplied with lever and weight unless plans require oil or air cushioning device.

F. Valve to have bolted removable cover for cleaning and maintenance.

G. 200 psi maximum working pressure rating for 3-inch through 12-inch valves, 150 psi for valves

larger than 12-inch, unless noted otherwise in the plans.

2.7 SILENT CHECK VALVES

A. Manufacturers:
1. Dezurik
2. Pratt
3. Val-Matic

Substitutions: City of Gadsden Division 105- General Conditions

B. Valve body constructed of ASTM A536 ductile iron (65-45-12).

C. Valve to incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to pipe size.

D. Seat and disc to be cast bronze or aluminum bronze. Compression spring to be Type 316 stainless steel.

E. Valve to have a replaceable guide bushing held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.

F. Valve disc to be concave to the flow direction.

G. Leakage rate not to exceed one-half the allowable rate for metal seated valves under AWWA C508 or 0.5 oz per hour per inch of valve diameter.

H. 250 psi maximum working pressure rating unless noted otherwise in the plans.

2.8 INSERTION VALVES

A. Manufacturers:
1. TEAM Industrial Services
2. Advanced Valve Technologies
3. Hydra-Stop

Substitutions: City of Gadsden Division 105- General Conditions

B. Valve body constructed of ASTM A536 ductile iron (65-45-12).

C. Hardware: 304 Stainless Steel

D. Seat and disc to be cast bronze or aluminum bronze. Compression spring to be Type 316 stainless steel.

E. Valve to have a replaceable guide bushing held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.

F. Leakage rate not to exceed one-half the allowable rate for metal seated valves under AWWA C508 or 0.5 oz per hour per inch of valve diameter.

G. 250 psi maximum working pressure rating unless noted otherwise in the plans.

2.9 AIR/VACUUM AND AIR RELEASE VALVES

A. Manufacturers:
1. ARI, Inc
2. APCO Valve and Primer Company
3. Crispin Valve
4. Valmatic Valve Co.

Substitutions: City of Gadsden Division 105- General Conditions

B. Air release and air/vacuum valves shall be specifically designed by the manufacturer for either clean water service (in the case of finished potable water or other non-solids bearing water systems) or sewage service (in the case of sewerage or other potentially solids bearing systems such as raw water service) as indicated in the plans.

C. Provide air/vacuum valves, air release valves, or combination air valves having the following functionality as indicated in the plans.
1. Air/Vacuum Valves shall open to exhaust large volumes of air in situations such as pipeline filling and shall also open to admit air for the purpose of relieving internal vacuum conditions in situations such as pipeline draining.
2. Air Release Valves shall open to exhaust small pockets of air while the pipeline is operating under pressure.
3. Combination Air Valves shall have the functionality of both air/vacuum valves and air release valves and may be of either the single body or dual body configured.

D. Design Requirements:
1. Provide Air Release and Combination Air Valves with minimum 5/16-inch orifice for exhausting small pockets of air while pipeline is operating under pressure.
2. Provide all air valves and all related accessories with pressure ratings equal to or greater than the maximum pipeline working pressure at the location of the air valve installation.
3. Provide all air valves with low pressure sealing capability equal to or less than 2 psi or, where specifically indicated in the plans, equal to or less than 1 psi.

E. End Connections:
1. 2-inch and smaller valves: Threaded end connections
2. Valves larger than 2-inch: Flanged end connections conforming to ANSI B 16.1 CL 125 unless otherwise indicated in the plans.

F. Accessories:
1. Provide the following accessories with each assembly:
a. For clean water service applications:
1) Provide inflow preventing device which prevents entry of external water into the pipeline system through the air inlet / outlet. Device shall allow the entry or exit of air while preventing entry of water.
2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.
a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.

b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.

b. For sewage service applications:

1) Provide backflushing accessories as follows:

a) Blow-off / drain connection and shut-off valve.

b) Clean water supply connection and shut-off valve.

c) Backwash supply hose with quick disconnect.

d) All shut-off valves shall be bronze, full-ported ball valves.

2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.

a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.

b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.

2.10 PILOT OPERATED CONTROL VALVES

A. Manufacturers:

1. Bermad
2. Cla-Val
3. Watts

Substitutions: City of Gadsden Division 105- General Conditions

B. Globe or angle pattern as indicated in the plans with ductile iron body and cover conforming to ASTM A 536. Provide with NSF 61 listed fusion bonded epoxy coating and interior lining. Studs and cover nuts shall be 316 stainless steel.

C. Stainless steel throttling components.

D. All trim shall be stainless steel.

E. Disc and diaphragm assembly shall contain a BUNA-N synthetic rubber seal securely retained on 3-1/2 sides by a disc retainer and disc guide.

F. End Connections:

1. For main valves larger than 2-inch, provide flanged end connections conforming to ASTM C115 ANSI B16.1 CL 125 unless otherwise indicated in the plans.
2. For main valves 2-inch and smaller, threaded end connections may be utilized if approved by the Engineer.

G. Pilot system:

1. Regulators, fittings, and valves shall be constructed of stainless steel. Pilot system tubing shall be constructed of braided, flexible stainless steel tubing. All components of the pilot system shall have a working pressure rating in excess of the anticipated pressure conditions shown on the plans.
2. Operation range suitable for the pressure range indicated in the plans.
3. Provide with an external Y-strainer, adjustable opening and closing speed components, and ball-type isolation cock valves.

4. All wetted surfaces contacted by consumable water shall contain less than 0.25% lead by weight.
5. Pilot system manufactured and assembled by the same company as the main valve.

H. Accessories:
1. Provide brass or stainless steel engraved nameplate for each control valve and associated pilot securely affixed to the associated component. Nameplate shall indicate the following information as applicable:
   a. Catalog and serial number
   b. Function, size, material, and pressure rating
   c. Type of pilot control system used and control adjustment range
2. Where indicated in the plans, provide valve position indicating post.
3. Where indicated in the plans, provide pressure gauges as follows:
   a. 4-inch diameter, glycerin-filled stainless steel with the pressure measurement range as indicated in the plans.
   b. Provide with threaded connections and stainless steel connecting tubing and fittings.
   c. Minimum of ½" diameter tap size or larger where indicated in the plans.
   d. Provide with quarter-turn ball shut-off valves.
   e. Provide with pulsation damper where indicated in the plans.
4. Where indicated in the plans, provide main-line strainer:
   a. Provide the same size as the control valve and installed immediately upstream from the control valve.
   b. Ductile iron body with epoxy coating matching that of the control valve body.
   c. Flanged end connections sized to match those of the associated control valve.
   d. Incorporate stainless steel screen which is removable for replacement or maintenance without removing the strainer body.
   e. NSF-61 certified.
   f. Assembly rated for the same working pressure as the control valve.
5. Where indicated in the plans, provide accessories, trim, and configuration which reduces internal cavitation.
6. Where required for valve function, provide solenoids suitable for operation on 120V single-phase AC power, with NEMA IV enclosure and manual operator unless indicated otherwise in the plans.

I. Control Valve Operations and Functionality:
1. Control valves of the following types shall function through a pilot control system as follows:
   a. Pressure Reducing Valves – Automatically reduce a varying upstream pressure to an operator-adjustable constant downstream pressure set point, regardless of flow rate. A decrease in downstream pressure shall cause the main valve to increase its opening, thereby increasing the downstream pressure toward the set point. An increase in downstream pressure shall cause the main valve to decrease its opening, thereby decreasing the downstream pressure toward the set point. Where specifically indicated in the plans, provide an internal check feature which prevents flow from downstream to upstream via the pilot control system.
   b. Pressure Relief Valves – Remain closed while upstream pressure is below an operator-adjustable set point. Open to exhaust water and relieve pressure when upstream pressure exceeds the set point.

c. Surge Anticipator Valves – Automatically open a pre-set amount upon upstream pressure falling below an operator adjustable set point in anticipation of oncoming surge. Automatically close upon pressure rising above set point.

d. Pressure Sustaining Valves – Automatically maintain upstream pressure at an operator-adjustable set point with varying downstream pressure, regardless of flow rate. A decrease in upstream pressure shall cause the main valve to decrease its opening, thereby decreasing the flow rate and increasing upstream pressure toward the set point. An increase in upstream pressure shall cause the main valve to increase its opening, thereby increasing the flow rate and decreasing the upstream pressure toward the set point.

e. Single Acting Altitude Valves – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level setpoint, then close fully. Upon the water level in the downstream tank or reservoir falling a pre-set distance, re-open fully. This valve shall be designed for one-way flow only.

f. Double Acting Altitude Valve – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level set point, then close fully. Upon either pressure on the upstream side falling below an operator-adjustable set point, or, the water level in the downstream reservoir or tank falling a pre-set distance, re-open fully. This valve shall be designed for two-way flow.

g. Solenoid-Controlled Open / Close Valve – Either open or close pilot system in response to a changing electrical current to the solenoid, which in turn either opens or closes the main valve. Solenoid shall be either normally open (open upon loss of electrical signal) or normally closed (close upon loss of electrical signal) as indicated in the plans.

h. Solenoid-Controlled Booster Pump Control Valve – Pump operation shall begin with the control valve closed. Upon pump start-up, simultaneously energize solenoid and begin opening the main valve slowly, as controlled by the opening speed control. Upon signal to shut-down pump, maintain the pump running, de-energize the solenoid, and begin slowly closing the main valve, as controlled by the closing speed control. Upon main valve reaching the fully-closed position, a limit switch shall release a valve / pump interlock, and the pump shall shut down. Where indicated in the plans an internal check feature shall be provided to prevent reverse flow.

i. Solenoid-Controlled Deep Well Pump Control Valve – Pump operation shall begin with the valve open. Upon pump start-up, simultaneously energize solenoid and begin closing the main valve slowly, as controlled by the closing pump speed control. Upon signal to shut down the pump or upon loss of power, the solenoid is de-energized, and the main valve begins to open slowly, as controlled by the opening speed control. Upon the main valve reaching the fully open position,

2.11 LINE STOPPING ASSEMBLIES

A. Manufacturers:
   1. JCM Industries

Substitutions: City of Gadsden Division 105- General Conditions

B. Blind Flange: 150 lb, ASTM A36 Carbon Steel, Epoxy Coated

C. Blind Flange Gasket: Styrene-Butadiene Rubber (SBR) compounded for use with water

D. Gasket: Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000

E. Bolts and Hardware: Stainless Steel 18-8 Type 304

F. Finish: Fusion applied Epoxy Coating per ANSI/AWWA C213 Standard

2.12 ACCESSORIES

A. Valve Boxes for Buried Valves:
1. 12-inch diameter valves and smaller: Domestic cast iron, two-piece, screw type for height adjustment.
2. Valves larger than 12-inch: Domestic cast iron, three-piece, screw type for height adjustment.
3. For either size condition, provide 6-inch ductile iron pipe riser sections as required for additional height where standard is insufficient.
4. Provide with cast iron lid marked “Water” or “Sewer” as applicable

B. Valve Markers for Buried Valves:
1. Provide fiberglass marker (either round or flat) or concrete monument as required in the plans. If no such indication is present, provide flat fiberglass marker.
2. For fiberglass markers, provide either blue color for potable water or green color for sewer. Provide with Owner’s standard labeling information as indicated in the plans or specifications. If no such information is present, provide minimum labeling as follows:
   a. “Warning – Water (Sewer) Pipeline Below”
   b. Notification to contact 811 service before digging
   c. Owner’s emergency contact information.
3. For concrete markers, provide dimensions as indicated in the plans. Provide with markings as shown in the plans. If no such information is present, provide minimum information as follows:
   a. “Water (Sewer) Valve

C. Valve Operating Nut Stem Extensions:
1. For buried valves where the valve operating nut is greater than 48-inches below the top of the valve box, provide a stainless steel stem extension designed to fit snugly and securely onto operating nut and with 2-inch square top operating nut designed to fit into standard valve wrench. Provide length as required so that top of operating nut is between 12 and 36 inches below the top of the valve box.
2. For non-buried valves, provide stainless steel stem extensions and appropriate mounting brackets / guides where indicated in the plans. For applications where electric or pneumatic actuators are utilized, extensions shall be suitably sized to withstand torque imparted by actuator.

D. Post Type Position Indicators:
1. Manufacturers:
   a. Mueller
   b. M and H Valve
   c. American Flow Control

2. Vertical Indicator Post designed to operate a non-rising stem gate valve with above ground visual indication of valve position (open or shut).
3. Indicator post shall feature a telescoping stem that can be adjusted to its final position without field cutting of the stem.

PART 3 EXECUTION

3.1 EXAMINATION

E. City of Gadsden Division 105- General Conditions

A. Determine exact location, configuration, features, and size of valves and accessories from the Plans; obtain clarification and directions from Engineer prior to execution of work.

B. Verify invert elevations of existing work prior to excavation and installation.

1.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.

1.4 EQUIPMENT START-UP AND COMMISSIONING

A. For pilot-operated control valves, provide on-site services of a manufacturer-certified start- up technician to initially establish set points prior to start-up and make adjustments to equipment as necessary following initial start-up. Start-up technician shall instruct Owner's staff on operation, maintenance and adjustments of equipment. Services shall be provided for a minimum of 8 hours on-site per control valve, and additionally as necessary if there are difficulties associated with the start-up, at no additional cost to the Owner.

1.5 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 01 10.

END OF SECTION

SECTION 33 1419.2

FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire Hydrants
2. Post Hydrants

B. Related Sections:
1. Drawings and general provisions of the Contract including General Conditions, Special Provisions and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:
1. AWWA C111 / A21.11-17 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
3. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray-Iron Fittings
4. AWWA C502 Dry-Barrel Fire Hydrants
5. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water-Supply Service.
6. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
7. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects

C. National Fire Protection Association
1. NFPA 281 – Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Fire Hydrant Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), gravel bedding, and provision and installation of fire hydrant, main size x 6” anchor tee, 6” isolation valve and associated valve riser (valve box)(or tapping sleeve and valve for installation on existing mains), concrete pad around top of valve box, valve marker, 6” ductile

   iron pipe, barrel extensions as required, connection to water main, joint restraints, general fill, testing, cleanup and restoration, and all related items.

B. Flush (Post) Hydrant Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans.

2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), gravel bedding ,and provision and installation of fire hydrant anchor tee, isolation valve and associated valve riser (valve box)(or tapping sleeve and valve for installation on existing mains), concrete pad around top of valve box, valve marker, ductile iron lead piping, barrel extensions as required, connection to water main, joint restraints, general fill, testing, cleanup and restoration, and all related items.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance and supporting data, from material suppliers stating that equipment and accessories provided meet or exceed AWWA Standards, NSF 61 certification, and specification requirements.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Record actual locations of hydrants and appurtenances.

C. Provide Operation and Maintenance Data for equipment indicating materials of construction, recommended maintenance activities and intervals, procedures for adjustments and troubleshooting, and sources for procurement of replacement parts.

D. Where required, provide spare parts and maintenance materials to Owner.

1.6 QUALITY ASSURANCE

A. Provide uniform color scheme for fire hydrants in accordance with local authority standards. Where no local authority standard exists, provide uniform color scheme in accordance with NFPA 281.

B. All Products for use in potable water systems shall be NSF 61 certified.

1.7 QUALIFICATIONS

A. Manufacturer:
   1. Utilize equipment and materials from Owner's standard list of acceptable manufacturers provided in the Special Provisions. If no such list is provided, utilize equipment and materials from list of acceptable manufacturers provided in these specifications.
   2. Company specializing in manufacturing Products specified in this section with minimum of three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. City of Gadsden Division 105- General Conditions

B. Prepare hydrants and accessories for shipment according to AWWA Standards and seal ends to prevent entry of foreign matter into product body.

C. Store products in accordance with manufacturer's written recommendations and instructions, and in areas protected from weather, moisture, or possible damage; do not store products directly on ground.

D. Handle products in accordance with manufacturer's written recommendations and instructions, and in such a manner as to prevent damage to interior or exterior mechanisms and surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. City of Gadsden Division 105- General Conditions

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:
   1. Mueller
   2. M and H Valve
   3. American Flow Control

   Substitutions: City of Gadsden Division 105- General Conditions

B. Dry-barrel Break-away Type: AWWA C502; ductile-iron body, compression type valve.
   1. Bury Depth: As indicated on the Drawings.
   2. Inlet Connection: 6 inches.
   3. Valve Opening: 5-1/4 inches diameter.
   4. Ends: Mechanical Joint or Bell End.

5. Bolts and Nuts: Corrosion resistant.
6. Coating: AWWA C550; interior.
7. Direction of Opening: Counterclockwise unless otherwise indicated.
8. Pressure Rating: 200 psig.

C. Nozzle Requirement: One pumper (4-1/2") and two hose (2").
1. Thread type shall be National Standard.
2. Attach nozzle caps by separate chains.

D. Finish: Primer and two coats of enamel color.

E. Hydrant shall be designed so that, when in place, no excavation will be required to remove the main valve or add extensions.

2.2 FLUSH (POST) HYDRANTS

A. Manufacturers:
1. Mueller
2. M and H Valve

Substitutions: City of Gadsden Division 105- General Conditions

B. Dry-barrel Break-away Type: ductile-iron body, compression type valve.
1. Bury Depth: As indicated on the Drawings.
2. Inlet Connection: 2-inch or 3-inch
3. Valve Opening: 2-1/4 inches diameter.
4. Ends: Mechanical Joint.
5. Bolts and Nuts: Corrosion resistant.
6. Coating: AWWA C550; interior.
7. Direction of Opening: Counterclockwise unless otherwise indicated.
8. Pressure Rating: 150 psig.

C. Nozzle Requirement: 2-½" Hose
1. Thread type shall be National Standard.
2. Attach nozzle caps by separate chains.

D. Finish: Primer and two coats of enamel color.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Determine exact location, configuration, features, and size of hydrants and accessories from Plans; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

3.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.

END OF SECTION

SECTION 33 3100

SEWER PIPE JOINT SEALING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe cleaning and flushing.
2. Plugging.
3. Bypassing sewage.
4. Joint testing.
5. Joint sealing.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Sewer Pipe Joint Sealing:
1. Basis of Measurement: By each.
2. Basis of Payment: Includes joint testing and joint sealing.

B. TV Inspection of Sewer Pipelines:
1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes pipeline flushing and cleaning, bypass pumping, TV inspection and audio/video taping of pipeline.

1.3 REFERENCES

A. ASTM International:
1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C150 - Standard Specification for Portland Cement.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit sealant and root growth inhibitor data.

C. Reports:
1. Submit in triplicate, weekly report with daily entries showing:
a. Location of joints sealed and successfully tested.
b. Results of air or liquid joint tests before and after sealing joints.
c. Volume of joint sealant or joint sealant/root treatment additive pumped.
d. Number of pounds of acrylamide and N, N-methylenebisarcylamide mixture, pounds pounds of ammonium persulfate, and gallons of root treatment additive material used each day including gallons of triethalonamine (TEA), height of ground water.

e. Location of pipe fractures and misalignment.
f. Location of leaking joints, including non-leaking joints failing in air test.
g. Location of connections discharging continuous flow or incorrectly connected to sewer main.

2. Submit weekly reports on form approved by Engineer prior to start of testing and sealing.

D. Video Tapes:

1. Submit completed video tape cassettes before and after joint sealing, identified by tape number, project name, and location taken. Video tapes to indicate pipe joints and connections and have audio track containing simultaneously recorded narrative commentary and evaluations of electrographer describing in detail condition of pipe interior.
2. Take groundwater measurements simultaneously with video taping.
3. Prior to starting work, submit certifications attesting to composition and manufacturer of joint sealing material, and root treatment additive, chemical compatibility of sealant material and root treatment additive material, and calibration of meters used to measure joint sealant and root treatment additive and pressure gages are accurate to within 1 gpm and 5 psi respectively.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Record actual locations of joints repaired.

1.6 QUALITY ASSURANCE

A. Television Camera:

1. Video output from camera(s) used must be capable of producing a minimum of 600 lines of horizontal resolution at center; optimum imagery with minimum illumination; and meet the requirements of EIA Standard Video Signal.

B. Packer Used for Joint Sealing:

1. Air impervious, pneumatically inflatable bladder on each end of mounting cylinder; seal ends of each bladder to cylinder by broad confining bands.
2. Connected at each end by winch powered cables.
3. Required to form positive seal between inflated bladders and interior periphery of sewer pipe and form annular void between inflated end bladders.
4. Designed to allow restricted quantity of sewage flow through packer at times.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. City of Gadsden Division 105- General Conditions

B. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.

C. Protect materials from damage by storage in secure location.

1.9 SEQUENCING

A. City of Gadsden Division 105- General Conditions

B. Sequence work in the following order.
1. Pressure clean each section of pipe.
2. Apply root inhibitor and/or root cutter.
3. Video inspect each section of pipe.
4. Install joint sealant.
5. Video re-inspection of completed work.

1.10 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Furnish schedule when sewer piping section is out of service for joint sealing.

PART 2 PRODUCTS

2.1 GROUT SEALANT

A. Chemical Grout:
1. Mixture of dry acrylamide and dry N, N-methylenebisacrylamide, in proportions capable of diluting aqueous solutions and when properly catalyzed, forming stiff gels.
2. With ability to tolerate ground water dilution and to react in moving water.
3. Viscosity of less than 2 centipoise, remaining constant until gelation concurs.
4. Reaction time controllable from 10 seconds to 1 hour.
5. Reaction produces continuous and irreversible gel.

B. Catalyst: Ammonium persulfate; use in combination with activator; use of catalyst containing Dimethyl Amino Propionitrile (DMAPN) is prohibited.

C. Activator: Triethanolamine or other compounds of equivalent properties.

D. Inhibitor: Potassium ferricyanide.

E. Root Growth Inhibitor:
1. Dichlorobenzonitrile meeting recommendations of grout manufacturer; root treatment additive capable of remaining active for minimum of two years.
2. Active ingredient for destroying root intrusions: Sodium methyldithiocarbamate.
3. Root cell inhibiting agent 2,6 -dichlorobenzonitrile (DICHLOBENIL); for each application disperse root control agent into clear, cool water free of acid, alkali, oxidizing agents, or large amounts of oil or other organic compounds or materials. Use tanks for transportation or storage of makeup water free of material listed above.

F. Portland Cement: ASTM C150, Type II.

G. Fine Aggregate: ASTM C33 gradation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify sewer pipe requiring joint sealing.

3.2 PREPARATION

A. Pipe Cleaning and Flushing:
   1. Perform cleaning of pipe interior to extent necessary to pass equipment and materials required for joint sealing.
   2. Flush foreign material cleaned from interior of sewer pipe, intercept, remove and legally dispose.
   3. Dumping of raw sewage on private property, in city streets, or water courses is not permitted.

B. TV Inspection of Piping: Perform television inspection of sewer pipe after cleaning to determine when root removal is required. Cut flush roots, not removed, with inside periphery of pipe. Visually inspect joints with television camera before and after sealing.

C. Plugging:
   1. Plug piping when:
      a. Depth of flow within sewer pipe is greater than 20 percent of inside diameter of sewer pipe.
      b. Exposing complete inside periphery of sewer pipe is required to conduct inspection, sealing, or testing.
   2. Repair damage resulting from plugging sewer piping.

D. Bypassing Sewage:
   1. Bypass sewage when plugging cannot control flows.
   2. Set up pump to handle peak sewage flow.
   3. Provide standby or reserve pumps at bypassing site.
   4. Capacity of standby or reserve pumps equal to, or greater than, peak flow of sewage to sewer pipe.
   5. Provide safety precautions including barricades, flashers, and flagmen.

3.3 APPLICATION

A. Root Control:
   1. Apply chemical root control agent by foaming or soaking in accordance with conditions in piping under treatment.
   2. Foam Application:
      a. Agent: Solution containing no less than 24 percent by weight of anhydrous vapam (sodium methyldithiocarbamate) and no less than 1.7 percent by weight of dichlobenil (2,6-dichlorobenzenitrile); containing surfactant capable of producing foam able to transmit pressure of 30 psi and yielding 20 gallons of foam for each gallon of solution.

b. Foam Concentration: Deliver foam to pipe to yield approximately 20 gallons of foam for each gallon of 5 percent solution.

3. Soaking Application:
   a. Agent: Aqueous solution containing 28 percent by weight or more of anhydrous vapam (sodium methyldithiocarbamate) and 1 percent by weight or more of dichlobenil (2,6-dicholorobenzenitrile) active layer of foam on contacted surfaces.
   b. Application: Fill entire pipe with freshly prepared and well mixed solution containing no less than 1 percent by volume of chemical agent specified above. Fully charged for soaking period of one hour, or not less than thirty minutes with solution being replenished to maintain level of solution above upper end of section under treatment and concentration at 1 percent by volume of root control agent; following specified soaking period, pass solution downstream to treat additional segments of piping, add additional root control agent to maintain concentration of solution at 1 percent, and charge each segment for designated soaking period by addition of solution.

B. Joint Sealing:
1. Seal joints failing pre-sealing test.
2. Monitor and record actual maintenance pressures when grouting and testing joints.
3. Pass sealing materials from dual independent pumping system, through instantaneously controlled and read flow meter to annular void in packer through dual hose systems.
4. When sealant material injected into joint exceeds 15 gallons in 8 inch pipe, stop injection. Do not resume sealing of joint until other joints in manhole run are sealed.
5. Reclean and repeat sealing process when positive seal cannot be achieved.
6. Clean joint after completion of setting of sealant material. Examine joint repair by television camera for visible defects. Repair defects prior to post-joint-sealing testing.

3.4 FIELD QUALITY CONTROL

A. Sections 01400 - Quality Requirements, 01700 - Execution Requirements.

B. Pre-Sealing Joint Test: Air test each joint between manholes, as follows:
1. Conduct pre-sealing test as specified for post-sealing test.
2. Record failure of pre-sealing test in weekly report.
3. Notify Architect/Engineer when pre-sealing test passes. Record this in weekly report, and discontinue joint sealing and post-sealing test sequence for joint.

C. Post-Sealing Joint Test:
1. Perform visual inspection of joint.
2. Apply positive air pressure in void area to raise void pressure between 5 and 8 psig above maximum ground water pressure and allow to stabilize due to temperature effect.
3. Complete air pressure stabilization.
   a. Test Pressure: Not less than maximum ground water pressure nor more than 7.5 psig above maximum ground water pressure at initiation of test procedure.
4. Record initial test pressure, stabilized test pressure, and period of time required to have 1.0 psig pressure drop from stabilized test pressure.
5. Minimum allowable test period is defined in the following for period and specific pipe diameters:

Diameter	Time (Min/Sec)
8 inches	0: 18
10 inches	0: 28
12 inches	0: 40
15 inches	1: 03
18 inches	1: 31
21 inches	2: 04
24 inches	2: 16
27 inches	2: 42

6. When pressure drop exceeds 1.0 psig from stabilized test pressure during minimum time specified above, joint has failed.
7. Discontinue test when minimum time has been completed and 1.0 psig pressure drop has not occurred from stabilized test pressure; in this circumstance, joint has satisfactorily passed test.
8. Use the following procedure for sealed joint failing air test:
   a. Visually inspect.
   b. Reseal.
   c. Visually inspect.
   d. Retested until successful test is obtained or sealant limit is attained.

END OF SECTION

SECTION 33 3113

SITE SANITARY SEWER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewage pipe.
2. Underground pipe markers.
3. Manholes.
4. Bedding and cover materials.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:
1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes excavation, bedding, pipe and fittings, connection to building service piping and to municipal sewer.

B. Cleanout:
1. Basis of Measurement: By the unit for nominal depth of 4 feet.
2. Basis of Payment: Includes excavating, unit installation with accessories, connection to sewer piping.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
3. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
8. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
12. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Product Data: Submit data indicating pipe material used, and pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.8 PRE-INSTALLATION MEETINGS – Not Required

A. City of Gadsden Division 105- General Conditions

B. Convene minimum one week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated.

1.10 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.1 SANITARY SEWAGE PIPE

A. Ductile Iron Pipe: ASTM A746, Service type, bell and spigot ends.
1. Fittings: Ductile iron.
2. Joints: AWWA C111, rubber gasket joint devices.
3. Lining: Cement Mortar or Ceramic Epoxy.

B. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring sealed gasket joint.
1. Fittings: ASTM D2321, PVC material.
2. Joints: ASTM F477, elastomeric gaskets.

C. Plastic Pipe: ASTM D1785, Schedule 40, Poly (Vinyl Chloride) (PVC) material; bell and spigot style solvent sealed joint ends.
1. Fittings: ASTM D2466, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.2 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.

2.3 MANHOLES

A. Manhole Lid and Frame Manufacturers:
1. John Bouchard and Sons Co.
2. East Jordan Iron Works.
3. Neenah Foundry.

Substitutions: City of Gadsden Division 105- General Conditions

B. Manhole Lid and Frame:
   1. Construction: Cast iron construction.
   2. Lid Design: Solid without vent holes.
   3. Nominal Lid and Frame Size: 24 inch diameter.

C. Manhole Construction and Eccentric Cone Top Section: Reinforced precast concrete sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches; nominal diameter of 48 inches.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 31 05 16.

B. Backfill and Cover to 2 feet Above Pipe: Fill Type A2, as specified in Section 31 05 16.

C. Soil Backfill from 2 feet Above Pipe to Finish Grade: Soil as specified in Section 31 00 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with coarse aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 16.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321 Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.

C. Install bedding at sides and over top of pipe to minimum compacted thickness of 24 inches.

D. Refer to Section 02324 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

E. Connect to building sanitary sewer outlet and municipal sewer system

F. Install plastic ribbon tape continuous over top of pipe buried 12 inches below finish grade.

G. Install trace wire continuous over top of pipe and located 12 inches above pipe.

H. Install site sanitary sewage system piping to 5 feet of building. Connect to building sanitary waste system.

3.5 INSTALLATION - MANHOLES

A. Excavate for manholes in accordance with Section 31 00 00.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Pressure Test: Test in accordance with Section 33 05 05.

C. Infiltration Test: Test in accordance with Section 33 05 05.

D. Deflection Test: Test in accordance with Section 33 05 05.

E. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.7 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 3123

FORCE MAINS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Force mains.
   2. Bedding and cover materials.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:
   1. Basis of Measurement: By linear foot.
   2. Basis of Payment: Includes hand trimming excavation, backfill, bedding, thrust restraints, pipe, and fittings.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   4. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   5. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   6. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. American Water Works Association:
   1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
   3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

D. Ductile Iron Pipe Research Association:
   1. DIPRA Section 1X, Thrust Restraint.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Shop Drawings: Submit shop drawings for ductile iron pipe. Indicate piece numbers and locations and restrained joint locations.

C. Product Data: Submit data indicating pipe material used, pipe accessories, restrained joint details and materials.

D. Design Data: Submit restrained joint design data and calculations for ductile iron pipe establishing lengths of restrained joint piping required.

E. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. City of Gadsden Division 105- General Conditions

B. Project Record Documents: Record location of pipe runs, connections, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Design ductile iron pipe restrained joints in accordance with DIPRA Section 1X Standards.

1.7 PRE-INSTALLATION MEETINGS – Not Required

A. City of Gadsden Division 105- General Conditions

B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. City of Gadsden Division 105- General Conditions.

B. Do not place materials on private property without written permission of property owner.

C. During loading, transporting and unloading, exercise care to prevent damage to materials.

D. Do not drop pipe or fittings.

E. Avoid shock or damage to pipe.

F. Take measures to prevent damage to exterior surface or internal lining of pipe.

G. Do not stack pipe higher than recommended by pipe manufacturer.

H. Store gaskets for mechanical and push-on joints in cool, dry location out of direct sunlight and not in contact with petroleum products.

1.10 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Coordinate the Work of connection to existing sewer force mains, manholes, or other facilities with Owner.

PART 2 PRODUCTS

2.1 FORCE MAIN

A. Ductile Iron Pipe: AWWA C151; standard cement mortar lining (AWWA C104) or Ceramic Epoxy lining (Protecto 401), outside coated.
   1. Pipe - 3 Inches to 12 Inches: Pressure Class - 350 psi.
   2. Pipe - 14 Inches to 24 Inches: Pressure Class - 250 psi.
   3. Pipe - 30 Inches to 48 Inches: Pressure Class - 150 psi.

B. Ductile Iron Fittings:
   1. AWWA C110; - 350 psi pressure rating.
   2. Fitting to be cement mortar or ceramic epoxy lined and outside coated as for ductile iron pipe.

C. Joints: AWWA C111, where not specifically indicated on Drawings.
   1. Type: Mechanical joint or push-on joint.

D. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: AWWA C111.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC Pressure Sewer Pipe and Fittings - 12" Nominal Pipe Size and Smaller:
1. ASTM D2241, PVC 1120; SDR 26.

2.3 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewage Force Main" in large letters.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 31 05 16.

B. Cover: As specified in Section 31 00 00.

C. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 00 00.

2.5 CONCRETE

A. Concrete in accordance with Section 32 16 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions.

B. Verify project is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over excavation with coarse aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 00 00.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with Drawings.

B. Route piping in straight line.

C. Refer to Section 31 00 00 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

D. Connect to municipal sewer system as shown on the Drawings.

E. Install detectable underground utility marking tape continuous over top of pipe.

3.5 INSTALLATION - THRUST RESTRAINT

A. Provide pressure pipeline with restrained joints or concrete thrust blocking at bends, tees, and changes in direction; construct concrete thrust blocking in accordance with Drawings.

3.6 INSTALLATION - CRADLES AND ENCASEMENT

A. Provide concrete cradles and encasement for pipeline where indicated on Drawings as specified in Section 32 16 00.

3.7 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Pressure test system to the greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Repair leaks and re-test.

1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
2. Provide all equipment required to perform leakage and hydrostatic pressure tests including water storage means, acceptable water volume measurement means, pumps, piping, calibrated pressure gauges, and chart recorder. Upon request of Engineer, provide certification of calibration of equipment acceptable to Engineer.
3. Test Pressure: The greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Obtain working pressure from Engineer.
4. Conduct hydrostatic test for at least six-hour duration.
5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, apply test pressure. At conclusion of tests, close and permanently seal resulting piping openings.
6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. Maintain test pressure within +/- 5 psi of specified test by pumping additional water in to the test segment. Accurately record test segment pressure continuously on chart

recorder and volume of additional water supplied to test segment. Additional water supplied shall be designated as the leakage.

9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{SDvP}{C}$$

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
p = average test pressure during leakage test, in pounds per square inch gauge
C = 133,200

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

C. Request inspection prior to and immediately after placing bedding.

D. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 4000

SITE STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Site Storm drainage piping.
2. Accessories.
3. Underground pipe markers.
4. Catch basins and plant area drains.
5. Cleanouts.
6. Bedding and cover materials.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - BASIS OF MEASUREMENT

A. Pipe and Fittings:
1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes excavating, bedding, pipe and fittings, connecting to building service piping and to storm drainage system.

B. Catch Basin and Cleanout:
1. Basis of Measurement: By each unit.
2. Basis of Payment: Includes excavating, bedding, unit installation with accessories, connecting to sewer piping.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
7. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

8. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
10. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 SUBMITTALS

A. City of Gadsden Division 105- General Conditions.

B. Product Data: Submit data indicating pipe, pipe accessories, and precast structures.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 PRE-INSTALLATION MEETINGS – Not Required

A. City of Gadsden Division 105- General Conditions

B. Convene minimum one week prior to commencing work of this section.

1.7 COORDINATION

A. City of Gadsden Division 105- General Conditions

B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, connection to roof drain system, and connection to municipal storm sewer system.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Concrete Pipe: ASTM C14, Class 3; unreinforced; maximum inside nominal diameter of 12 inches, bell and spigot ends.
   1. Fittings: Concrete.
   2. Joints: ASTM C443, rubber compression gasket joint.

B. Reinforced Concrete Pipe: ASTM C76, Class III with Wall Type B; mesh reinforcement; bell and spigot ends.
   1. Fittings: Reinforced concrete.
   2. Joints: ASTM C443, rubber compression gasket.

C. Plastic Pipe: ASTM D3034, Type PSM, Polyvinyl Chloride (PVC) material; bell and spigot style rubber ring sealed gasket joint.
   1. Fittings: PVC.
   2. Joints: ASTM F477, elastomeric gaskets.

D. Corrugated Steel Pipe: plain end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.
   1. Fittings: Corrugated steel.
   2. Joints: Corrugated steel pipe coupling bands, galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.2 ACCESSORIES

A. Filter Fabric: Non-biodegradable, non-woven.

B. Grout: Specified in Section 32 16 00.

2.3 CATCH BASINS AND PLANT AREA DRAINS

A. Catch Basin/Inlet Construction:
   1. Concrete block and mortar.
   2. Cast-in-place reinforced concrete.
   3. Pre-cast concrete.
   4. Polyethylene.

   Substitutions: City of Gadsden Division 105- General Conditions

B. Catch Basin/Inlet Lid and Frame:
   1. Construction: Cast iron.
   2. Load Design: Traffic rated unless otherwise shown on Drawings.
   3. Lid Shape: Round Junction Box Lid; Square or Rectangle Inlet Lid; As shown on Drawings.

C. Base Pad: Cast-in-place concrete of type specified in Section 32 16 00.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A1 as specified in Section 31 05 16.

B. Cover: Fill Type: Fill type A2, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil type as specified in Section 31 00 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. City of Gadsden Division 105- General Conditions

B. Verify trench cut 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 fine aggregate.

B. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 16 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Place pipe on minimum 6 inch deep bed of Type A1 filter aggregate.

C. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 100 feet.

D. Install aggregate at sides of pipe.

E. Refer to Section 31 23 16 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

F. Connect to building downspouts where required.

G. Connect to subdrainage tile system piping.

H. Install site storm drainage system piping to 5 feet of building. Connect to building storm drainage system.

3.5 INSTALLATION - CATCH BASINS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. City of Gadsden Division 105- General Conditions

B. Request inspection prior to placing aggregate cover over pipe.

C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Infiltration Test: Test in accordance with ASTM 969.

3.7 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION