

**PROJECT MANUAL
CONSTRUCTION DOCUMENTS AND SPECIFICATIONS
FOR
BROOKHAVEN PARK IMPROVEMENTS
BROOKHAVEN, GEORGIA**

CITY RFQ 23-103

04 - - 2023



04-18-23



LOSE PROJECT # 19002

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Prepared for:

**CITY OF BROOKHAVEN, GEORGIA
PARKS AND RECREATION DEPARTMENT**

**3360 OSBORNE ROAD NE
BROOKHAVEN, GEORGIA 30319**



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RFQ NO. 23-103

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PART 1 - GENERAL

- A. Subsurface investigation has been performed at the site by the Owner. This investigation was conducted, and the reports obtained, solely for design purposes and are not a part of the Contract Documents.
- B. The use and interpretation of this information will be entirely the responsibility of the using party. Neither the Owner nor any Designer on the project is responsible for variations in the subsurface conditions. Bidders shall decide for themselves the character of the material to be encountered.
- C. The report(s) of the findings of this investigation follow this section.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION 00 31 32

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to Site
 - 4. Work restrictions.
 - 5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

- A. Project Identification: BROOKHAVEN PARK IMPROVEMENTS
- B. Project Location: 2660 OSBORNE ROAD
BROOKHAVEN, GEORGIA 30319
- C. Owner: CITY OF BROOKHAVEN PARKS AND RECREATION DEPARTMENT
 - 1. Owner's Contact: KAREN OWENS, DIRECTOR
CITY OF BROOKHAVEN PARKS AND RECREATION
3360 OSBORNE ROAD
BROOKHAVEN, GEORGIA 30319
- D. Designer of Record:
 - 1. Site Development: AARON ST. PIERRE, ASLA, LANDSCAPE ARCHITECT
LOSE DESIGN (DBA LOSE & ASSOCIATES, INC.)
220 WEST CROGAN
LAWRENCEVILLE, GA 30046
PHONE: (770) 338-0017

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
 - 1. The project includes, but not limited to the following:

Demolition of the existing structures including a building, pavilion, playground, and pavement; site clearing, mass grading, erosion and sediment control facilities; water distribution facilities; sanitary sewer facilities; storm sewer facilities; electrical service infrastructure; and other items as noted on the plans in order to construct new buildings

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(1 restroom and pavilion building with associated outdoor patio in the dog park area, 1 restroom building near the playground, 2 small shade pavilion, 1 large group pavilion, 2 shaded seating areas, remove and replace an existing pavilion with a new pavilion), a new playground area, a new parking lot, an emergency access drive and pedestrian facilities. The project includes piping modifications to an existing headwall at a water of the state.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations during construction period as directed by the Owner.
- B. Contractor to ensure that public access to the existing DeKalb Services Center is maintained during construction. Any work that may impact the useability of the Services Center (such as utility connections and / or paving work) should be coordinated at least 72 hours in advance of work.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, site parking, patron operations and other requirements of authorities having jurisdiction.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications and are collectively incorporated as the "General Requirements".
- C. Material Coordination: Requirements for materials and products are identified in detail within the Specifications and / or on the Drawings. One or more of the following are used in the Specifications to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

END OF SECTION 01 10 00

SECTION 01 22 00 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Unit price work.
 - 2. List of unit prices required.
 - 3. Procedures for unit price work.

1.3 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 SUBMITTALS

- A. Supporting Data: With applications for payment covering unit price work submit substantiated measurement of quantity installed or executed.

1.5 PROCEDURES

- A. Unit Prices include all costs necessary to satisfactorily complete the work, including materials, delivery, labor, installation, insurance, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Contractor's expense, by an independent surveyor acceptable to Owner.
- D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

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UNIT PRICES - SECTION 01 22 00

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- E. Unit Price Quantities: In case of unit price quantity discrepancies between Bid Form and this form, or any other section, the unit price quantities stated on the Bid Form shall prevail.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. **Unit Price 1: Rock, Open Excavation:**

1. Description: Removal of mass rock encountered and requiring excavation as defined in the specifications.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Cubic Yard
4. Quantity to be included on Contract Sum: **100 CY**
5. Include only the following in the unit price: Excavation to plan subgrade, hauling and disposal off site, cost of providing sufficient and suitable fill material from off site to form subgrade to original level of rock removed, overhead and profit.
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.

B. **Unit Price 2: Rock, Trench Excavation:**

1. Description: Removal of trench rock encountered and requiring excavation as defined in the specifications.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Cubic Yard
4. Quantity to be included on Contract Sum: **100 CY**
5. Include only the following in the unit price: Excavation to bottom and full width of trench, hauling and disposal off site, cost of providing sufficient and suitable fill material from off site to form subgrade to original level of rock removed, overhead and profit.
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.
8. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.

C. **Unit Price 3: Excavation of Unsatisfactory Material and replacement with Satisfactory Earth Fill:**

1. Description: Removal of unsatisfactory materials encountered and requiring excavation and replacement with earth fill to subgrade shown on plans, as defined in the specifications
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Cubic Yard
4. Quantity to be included on Contract Sum: **100 CY**

5. Include only the following in the unit price: Excavation to plan subgrade, hauling and disposal off site, cost of providing sufficient and suitable earth fill material to subgrade, overhead and profit.
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.

D. **Unit Price 4: Excavation of Unsatisfactory Material and replacement with GAB:**

1. Description: Removal of unsatisfactory materials encountered and requiring excavation and replacement with GAB to subgrade shown on plans, as defined in the specifications.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Cubic Yard
4. Quantity to be included on Contract Sum: **100 CY**
5. Include only the following in the unit price: Excavation to plan subgrade, hauling and disposal off site hauling and disposal off site of unsatisfactory materials, cost of providing sufficient and crushed stone to subgrade, overhead and profit.
6. Include all other costs in contract sum.

E. **Unit Price 5: Excavation of Unsatisfactory Material and replacement with #57 stone or surge stone:**

1. Description: Removal of unsatisfactory materials encountered and requiring excavation and replacement with #57 crushed stone or surge stone to subgrade shown on plans, as defined in the specifications.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Cubic Yard
4. Quantity to be included on Contract Sum: **100 CY**
5. Include only the following in the unit price: Excavation to plan subgrade, hauling and disposal off site of unsatisfactory materials, cost of providing sufficient and crushed stone to subgrade, overhead and profit.
6. Include all other costs in contract sum.

F. **Unit Price 6: Silt Fence**

1. Description: Construction of silt fence, as defined in the plans.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Linear Foot
4. Quantity to be included on Contract Sum: **300 LF**
5. Include only the following in the unit price: Material and construction of the silt fence per detail 1/C2.90; maintenance, repair, replacement and removal of silt fence; overhead and profit
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.
8. Control, latest edition. Maintain, repair, replace as needed and removal of silt fence per plans and specifications; overhead and profit.
9. Include all other costs in contract sum.
10. Method of measurement: Measurement will be made as outlined in the specifications and verified by the owner.

G. **Unit Price 7: Silt Sock in lieu of Silt Fence**

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1. Description: Construction of silt sock fence in lieu of silt fence shall be used where silt fence is within the critical root zones of existing trees to remain.
2. Purpose: To adjust the contract sum when actual quantity is determined. Credit shall be given per linear foot of Silt Fence replaced by silt sock per unit price for Unit Price 6.
3. Unit of Measurement: Linear Foot
4. Quantity to be included on Contract Sum: **350 LF**
5. Include only the following in the unit price: Material and construction of the silt sock installed per Manufacturer's specifications. Maintain, repair, replace as needed and removal of silt sock per plans and specifications; overhead and profit
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications for silt fence and verified by the owner.

H. **Unit Price 8: Sod (per specifications)**

1. Description: Installation of additional sod per plans and specifications as requested by owner or owner's representative and/or where needed to provide a permanent erosion control solution above and beyond that which is indicated and quantified on the plans.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Square Foot
4. Quantity to be included on Contract Sum: **1000 LF**
5. Include only the following in the unit price: Material and installation of the sod installed per plan notes and detail(s). Water, maintain, repair, replace as needed until project acceptance by owner; including overhead and profit
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications for sod and verified by the owner and/or owner's representative.

I. **Unit Price 9: Seeding (per specifications)**

1. Description: Application of additional seeding per plans and specifications as requested by owner or owner's representative and/or where needed to provide a permanent erosion control solution above and beyond that which is indicated and quantified on the plans.
2. Purpose: To adjust the contract sum when actual quantity is determined.
3. Unit of Measurement: Square Foot
4. Quantity to be included on Contract Sum: **1000 LF**
5. Include only the following in the unit price: Material and application/installation of the seed, and appurtenances installed per plan notes and specification. Water, maintain, repair, replace as needed until seed has established and/or project acceptance by owner; including overhead and profit.
6. Include all other costs in contract sum.
7. Method of measurement: Measurement will be made as outlined in the specifications for seeding and verified by the owner and/or owner's representative.

END OF SECTION 01 22 00

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SECTION 012300 – ALTERNATES

PART 1- GENERAL

1.1 DESCRIPTION:

- A. An Alternate is an amount proposed by Bidders, and stated on the Bid Form, for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the City decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
- B. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.
- C. Alternate pricing shall include all materials, supervision, overhead and profit for each alternate bid item.
- D. Related Work Described Elsewhere:
 - 1. Materials and methods to be used in the Base Bid and in the Alternates have been described on the Drawings and in pertinent Sections of these Specifications.
 - 2. Method for stating the proposed Contract Sum is described in the bid form.

1.2 SELECTION AND PURCHASE

- A. All Alternates described in this Section are required to be reflected on the Bid Form as submitted by Bidders. Failure to submit an alternate price may cause the entire bid to be determined non-responsive and rejected. Do not submit Alternates other than as described in this Section.
- B. If the City elects to proceed on the basis of one or more of the Alternates, the Contractor shall make all modifications to the work required in furnishing and installing the selected Alternates to the approval of the City and at no additional cost to the City other than as proposed on the Bid Form.
- C. All Alternates must be executed with an appropriate response. A "blank space" or a "No Bid" statement is inappropriate and non-responsive. The space MUST INCLUDE a "Specific Amount, Percentage or Sum" or a "No Change in Price" or a "Zero Dollar Cost" statement. Failure by the Bidder to provide this information may be cause for rejection of the Bid at the County's discretion.

PART 2- SCHEDULE OF ALTERNATES

2.1 ALTERNATE NO. 1 (ADD): BUILDING B3- GARDEN PAVILION

The Contractor shall add to the Contract with the City, all work necessary and required to provide and install Building B3 as indicated on the contract documents, including: demolition (per specifications) of existing pavilion, necessary erosion control and tree protection measures as well as associated electrical service.

2.2 ALTERNATE NO. 2 (ADD): BUILDING C- LARGE (SOUTH) PAVILION

The Contractor shall add to the Contract with the City, all work necessary and required to provide and install Building C as indicated on the contract documents, including: associated electrical service.

2.3 ALTERNATE NO. 3 (ADD): BUILDING E2- SHADE STRUCTURE 2

The Contractor shall add to the Contract with the City, all work necessary and required to provide and install Building E2 as indicated on the contract documents, including: associated electrical service.

END OF SECTION 01 23 00

SECTION 012400 - WEATHER DELAYS

PART 1 – GENERAL

1.1 EXTENSIONS OF CONTRACT TIME:

- A. If the basis exists for an extension of time, an extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.

1.2 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE:

- A. Refer to the City of Brookhaven ITB document Exhibit B: Specifications and Scope of Work, Special Conditions, Item number 25 for baseline bad weather days.
- B. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within 24 hours as determined by the Owner:
 - 1. Precipitation (rain, snow, or ice) in excess of 0.10" liquid measure.
 - 2. Temperatures which do not rise above 32 degrees F by 10:00 a.m.
 - 3. Temperatures which do not rise above that specified for the day's construction activity by 10:00 a.m., if any are specified.
 - 4. Sustained wind in excess of 25 m.p.h.
 - 5. Standing snow in excess 1".
- C. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:
 - 1. For rain days above the standard baseline.
 - 2. Only if there is a hindrance to site access or sitework, such as excavation, backfill, and footings.
 - 3. At a rate no greater than 1 make-up for each day or consecutive days of rain beyond the standard baseline that total 1" or more, liquid measure, unless specifically recommended otherwise by the Engineer.
- D. A Weather Delay Day may be counted if adverse weather prevents work on the Project for 50% or more of the Contractor's scheduled work day, including a weekend day or holiday if Contractor has scheduled construction activity that day.

1.3 DOCUMENTATION AND SUBMITTALS

- A. Submit daily jobsite work logs showing which and to what extent construction activities have been affected by weather on a timely basis.
- B. Submit actual weather data to support claim for time extension from nearest NOAA weather station or other independently verified source approved by the Engineer at beginning of Project.
- C. Use Standard Baseline data provided in this Section when documenting actual delays due to weather in excess of the average climatic range.

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WEATHER DELAYS – SECTION 01 24 00

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- D. Organize claim and documentation to facilitate evaluation on a basis of calendar month periods, and submit in accordance with the procedures for Claims established herein.
- E. If an extension of Contract Time is appropriate, it shall be affected in accordance with the provisions in the General Conditions.

END OF SECTION 01 24 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Sections:
 - 1. Division 01 Section “Quality Requirements” for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

- A. Substitution Requests: Submit ONE digital copy of each request to the Designer for review and consideration, prior to completion of Project Bidding Period. Substitution requests will not be considered during the construction phase of the project, unless there is a significant benefit to Owner and a noted reduction in budget.
- B. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of Designers and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation within two (2) days of receipt of a request for substitution during the Bidding Period. Designer will notify Contractor of acceptance or rejection of proposed substitution within via Addendum. Requested additional material for evaluation, which is received after the final question submittal date will not be considered and the request for substitution may be rejected due to insufficient material for review.
4. Construction Period material changes: If a material is selected for substitution during construction, then the following methods will be utilized to implement the change:
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Designer's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Designer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: This is noted for implementation during the construction timeframe only. Submit requests for substitution immediately upon discovery of need for change, but not later than five (5) days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Designer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Designer will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.
- C. Substitution Cost Savings: Should the proposed product substitution provide a savings in material or labor cost, then the savings will be stated to the Owner during the application process for part of the consideration.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

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SUBSTITUTION PROCEDURES – SECTION 01 25 00

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Exhibit A.15 – Contract Adjustments of the City of Brookhaven ITB Document.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. The designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Designer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Designer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

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CONTRACT MODIFICATION PROCEDURES – SECTION 01 26 00

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- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Designer.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, **Designer** will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Designer may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections:
 - 1. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Designer at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.

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PAYMENT PROCEDURES – SECTION 01 29 00

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- b. Name of Designer.
 - c. Designer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum. The Pay Application may not be reviewed until a current Schedule of values is submitted for review.

1.5 APPLICATIONS FOR PAYMENT

- A. Application for Payment shall be consistent with previous applications and payments as certified by Designer and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
 - 2. Payment discrepancies: each contractor payroll submitted must be compared to the wage requirements of the contract for conformity. If payroll discrepancies are found, the Contractor must be notified of the discrepancy as soon as possible.
 - a. The original payroll submitted is not required to the Contractor. Corrections are to be made by supplemental payrolls if required, prepared and submitted in the same manner as the original payroll. Whatever the discrepancy may be, proper correction documentation must be received and approved promptly.
 - b. The corrections received from the contractor shall be attached to the appropriate related payroll.
 - c. In the event corrections are not received in a timely manner, monthly progress estimates may be withheld.
 - d. In some cases the necessity of notifying the Department of Labor may be required. However, issues should be resolved at the lowest level possible.
 - e. Contractor payroll files must be made available to the Tennessee Department of Labor and Workforce Development for review as needed.
- B. Payment Application Times: Progress payments shall be submitted to Designer by the 25th of the month. The period covered by each Application for Payment is one month, ending on the 25th day of the month.
 - 1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Designer.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Designer will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Employee Classifications: The employee classification must agree with the Classifications listed in the required wage scales.
- F. Payment Application Sequence: Contractor payrolls should be numbered consecutively. A procedure should be established to ensure that all contractor and subcontractor payrolls are

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received within the allotted time. Progress estimates may be withheld if payrolls are not received within the allotted time.

- G. Work Interruptions/Stoppages: If the work of the prime contractor or subcontractor is interrupted for a week or more, a statement must be placed on the signature sheet of the payroll "No additional work will be performed until further notice." If work stops for a week or more, and is not anticipated, the statement "No work performed, and no work will be performed until further noticed."
- H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Contractor may submit for reimbursement of material stored on-site only. Materials stored off site are not acceptable for inclusion on the Application for Payment.
 - 2. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 3. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 4. Provide summary documentation for stored materials indicating the following:
 - a. Materials previously stored and included in previous Applications for Payment.
 - b. Work completed for this Application utilizing previously stored materials.
 - c. Additional materials stored with this Application.
 - d. Total materials remaining stored, including materials with this Application.
- I. Transmittal: Submit Three (3) signed and notarized original copies of each Application for Payment to Designer by a method ensuring receipt within 48 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- J. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- K. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Key Personnel
3. Administrative and Supervisory Personnel
4. Requests for Information (RFIs).
5. Pre-construction Conference
6. Project meetings.

- B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Designer, or Contractor seeking information from each other during construction.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Project closeout activities.
 - 7. Startup and adjustment of systems.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel on site when construction activity is underway, as required for proper performance of the Work.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Designer will return RFIs submitted to Designer by other entities controlled by Contractor 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 information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Designer.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Designer.
 1. Identify each page of attachments with the RFI number and sequential page number.
 2. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Designer's Action: Designer will review each RFI, determine action required, and respond. Allow five (5) working days for Designer's response for each RFI. RFIs received by Designer 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Designer's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Designer's action may include a request for additional information, in which case Designer's time for response will date from time of receipt of additional information.
 3. Designer'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 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Designer in writing within five (5) days of receipt of the RFI response.
- E. On receipt of Designer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Designer within two (2) days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Designer.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Designer's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct biweekly meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Designer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meetings will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Designer, within three (3) days of the meeting.

- B. Preconstruction Conference: Designer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Designer, but no later than fourteen (14) days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Designer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings during installation process.
1. Coordinate dates of meetings with preparation of payment requests.
Attendees: In addition to representatives of Owner and Designer, each contractor, 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 meeting 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 for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours
 - 10) Hazards and risks
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or

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recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Submittals Schedule.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Field condition reports.
 - 7. Special reports.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Designer.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

- G. Fagnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- H. Major Area: A story of construction, a separate building, or a similar significant construction element.
- I. Milestone: A key or critical point in time for reference or measurement.
- J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF file.
 - 3. Three paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit three copies at monthly intervals.
- H. Material Location Reports: Submit three copies at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Designer's request.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Designer.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than seven days for startup and testing.
5. Commissioning Time: Include no fewer than 15 days for commissioning.

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6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Designer's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.

- f. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Division 1 "Payment Procedures" for cost reporting and payment procedures.
 - 2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Designer's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - 3. Each activity cost shall reflect an accurate value subject to approval by Designer.
 - 4. Total cost assigned to activities shall equal the total Contract Sum.
- G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and the Contract Time.
- H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise the schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with an updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- J. Distribution: Distribute copies of approved schedule to Designer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within 15 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of the date established for the Notice to Proceed.
 - 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.10 CPM SCHEDULE REQUIREMENTS

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - b. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and final completion.
 - l. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.11 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Work Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on

and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit, with a request for interpretation, on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION 01 32 00

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
 - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 3. Division 01 Section "Quality Requirements" for submitting test and inspection reports.
 - 4. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 6. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action submittals: Written and graphic information that requires Designer's responsive action.
- B. Informational Submittals: Written information that does not require Designer's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL FORMATS

- A. Identification: Provide electronic copy submittal with project name and number file naming system. Samples and finishes material for color, texture and pattern selection must be a physical sample and hardcopy submittal. Provide 3 copies each.
 - 1. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier, and alphanumeric suffix for resubmittals.
- B. Deviations and Additional Information: On each submittal, clearly indicated deviations from requirements in the Contract Documents, including minor variations and limitations, include relevant additional information and revisions, other than those requested by Designer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

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SUBMITTAL PROCEDURES – SECTION 01 33 00

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1.5 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Designer for Contractor's use in preparing submittals.
- B. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and transmit them to Designer by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Designer.
 - 2. Contractor may select Web Based Project Software. Program must be set up and maintained by the Contractor.
 - a. Web Based Project Software: Prepare submittals in PDF form and upload them to web based Project software website. Enter required data in web-based software site to fully identify submittal.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Designer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Designer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Designer's consultants, Owner, or other parties is indicated, allow **21** days for initial review of each submittal.
 - 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Designer and to Designer's consultants, allow 15 days for review of each submittal. Submittal will be returned to Designer before being returned to Contractor.
- E. Additional Copies: Unless additional copies are required for final submittal, and unless Designer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Designer.

2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Designer will return submittals, without review received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractors, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Designer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- G. Resubmittals: Make resubmittals in the same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "approval notation from Designer's action stamp."
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals with mark indicating "approval notation from Designer's action stamp" taken by Designer.

1.6 CONTRACTOR'S USE OF DESIGNER'S CAD FILES

- A. General: At Contractor's written request, copies of Designer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the Designer rules and condition.

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SUBMITTAL PROCEDURES – SECTION 01 33 00

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PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Submit electronic submittals directly to extranet specifically established for Project.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Number of Copies: Submit electronic copies of Product Data, unless otherwise indicated. Designer will return markup electronic copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.

- k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Number of Copies: Submit electronic copies of each submittal. Designer.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
 - 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Designer will return submittal with options selected.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- 1. Type of product. Include unique identifier for each product.
 - 2. Number and name of room or space.
 - 3. Location within room or space.
 - 4. Number of Copies: Submit electronic copies of product schedule or list, unless otherwise indicated. Designer will return marked up copies.
 - a. Mark up and retain one returned copy as a Project Record Document.

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- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.
- G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
 - 4. Number of Copies: Submit electronic copies of subcontractor list, unless otherwise indicated. Designer will return mark-up copies.
 - a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit electronic copies of each submittal, unless otherwise indicated. Designer will not return copies.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of the firm or person. Include lists of completed projects with project names and addresses, names and addresses of Designers and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure

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Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

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- P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Designer, except as required in "Action Submittals" Article.
 - 1. Designer will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Designer.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit electronic copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Designer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 DESIGNER'S ACTION

- A. General: Designer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Designer will review each submittal, make marks to indicate corrections or modifications required, and return it. Designer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
- C. Informational Submittals: Designer will review each submittal and will not return it or will return it if it does not comply with requirements. The Designer will forward each submittal to the appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

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- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Designer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. The use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified

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installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
 2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Designer.

1.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Designer.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or

conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Designer for direction 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 Designer for a decision before proceeding.

1.5 SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- E. Reports: Prepare and submit certified written reports and documents as specified.
- F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.

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5. Names of individuals doing tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce the required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. 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 the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform the same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Designer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

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- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Designer.
 3. Notify the Designer seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform the same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Designer's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 8. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by the Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when requested.

- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- D. Testing Agency Responsibilities: Cooperate with Designer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Designer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform duties of Contractor.

- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.

- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. The date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. The date test or inspection results were transmitted to Designer.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Designer's reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or match existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. City of Brookhaven Tree Protection Code (Current Version)
 - 1. If conflicts arise between the City's code and this document, the City code shall prevail.

1.2 SUMMARY

- A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for limits placed on Contractor's use of the site.
 - 2. Division 1 Section "Temporary Facilities and Controls" for temporary tree protection.
 - 3. Division 31 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
 - 4. Division 31 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
 - 5. Division 32 Section "Exterior Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 ACTION SUBMITTALS

- A. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA or Certified Arborist-Municipal Specialist as certified by ISA Licensed arborist in jurisdiction where Project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.5 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:

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1. Storage of construction materials, debris, or excavated material.
 2. Moving or parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 63-mm sieve and not more than 10 percent passing a 19-mm sieve.
- B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.
1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood, Ground or shredded bark, or Wood and bark chips
 2. Size Range: 3 inches maximum, 1/2 inch minimum
 3. Color: Natural.
- E. Fencing Materials: See project drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a blue vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

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- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.2 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install gates as shown on drawings.
- B. Maintain protection zones free of weeds and trash.
- C. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.3 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 3 "Earthwork" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.4 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

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1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Cut Ends: Coat cut ends of roots more than in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Division 3 "Earthwork."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches inside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.5 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning raising reducing and thinning where indicated.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and dispose of off-site, or in area approved by Architect.

3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

- D. Minor Fill within Protection Zone: Where existing grade is or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of 6-inch caliper size and of a species selected by Architect when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.
 - 2. Plant and maintain new trees as specified in Division 32 "Exterior Plants."
- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 4-inch uniform thickness to remain.
- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2 inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Division 01 Section "References" for applicable industry standards for products specified.
 - 2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

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1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Initial Submittal: Within **30** days after the date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 4. Completed List: Within 60 days after the date of commencement of the Work, submit 3 copies of the completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 5. Designer's Action: Designer will respond in writing to Contractor within 15 days of receipt of completed product list. The Designer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Designer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

- e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of Designers and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Designer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
 - b. Use product specified if Designer cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Designer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Designer cannot decide on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

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1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, the Designer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Designer will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Designer's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 4. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that

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- complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
5. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 6. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
 7. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
 8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Designer's sample. The Designer's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
 9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Designer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Designer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Requested substitution does not require extensive revisions to the Contract Documents.
- B. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- C. The substitution request is fully documented and properly submitted.
- D. Requested substitution will not adversely affect Contractor's Construction Schedule.
- E. Requested substitution has received necessary approvals of authorities having jurisdiction.
- F. Requested substitution is compatible with other portions of the Work.

- G. Requested substitution has been coordinated with other portions of the Work.
- H. Requested substitution provides specified warranty.
- I. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Designer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Designer will return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of Designers and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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PRODUCT REQUIREMENTS - SECTION 01 60 00

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SECTION 01 73 00 - EXECUTION

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting surveys.
 - 2. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

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EXECUTION - SECTION 01 73 00

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1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to managing Design Professional. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify the managing Design Professional promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify the managing Design Professional when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the project manager and all applicable Design Professionals associated.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of the project manager or Engineer in charge. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to the project manager or Engineer in charge before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

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EXECUTION - SECTION 01 73 00

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2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- D. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- E. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

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3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Pre-installation Conferences: Include Owner's construction forces at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Refer to Cutting and Patching section.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

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- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements may include the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.
 - 5. Control systems.
 - 6. Communication systems.
 - 7. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements may include the following:
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Equipment supports.
 - 4. Piping, ductwork, vessels, and equipment.
 - 5. Noise- and vibration-control elements and systems.
 - 6. Insert miscellaneous element.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's

CUTTING AND PATCHING - SECTION 01 73 29

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aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

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SECTION 01 77 00 - CLOSEOUT PROCEDURES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Final completion procedures.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
 - 2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements. Designer will prepare a final Certificate for Payment after inspection

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or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

- i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Replace parts subject to unusual operating conditions.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one of file prints.
 - 2) Designer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one paper copy set of marked-up record prints
 - 2) Submit record digital data file and three sets of record digital data file plots
 - a) Electronic Media may be a USB drive or CD-R.
 - 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one annotated PDF electronic file of Project's Specifications, including addenda and contract modifications.

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- C. Record Product Data: Submit one annotated PDF electronic file of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Designer's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Designer. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to Designer for resolution.
 3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
 4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Designer will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Designer. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, operating in Microsoft Windows operating system.
 3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Designer for resolution.
 5. Designer will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 - a. Designer makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
 - b. CAD Software Program: The Contract Drawings are available in CAD program and operating system.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Designer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Designer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Designer.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Designer's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training videotapes.
- B. Related Sections may include the following:
 - 1. Division 01 Section "Project Management Coordination" for requirements for pre-instruction conferences.
 - 2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. At completion of training, submit one complete training manual(s) for Owner's use.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- D. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect
 - d. Name of Contractor.
 - e. Date videotape was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

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2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.
- D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 1. Overhead coiling doors.
 2. HVAC systems, including air-handling equipment and air distribution systems.
 3. HVAC instrumentation and controls.

4. Electrical service and distribution, including transformers, switchboards, panelboards and motor controls.
 5. Lighting equipment and irrigation controls.
 6. Communication systems, including voice and data equipment.
 7. All pool equipment and features including pumps, filtration, chlorination, routing, system monitoring, etc.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following for the pool equipment and systems:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.

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- k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

- A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Format: Provide high-quality digital color video on DVD.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 01 79 00

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SECTION 024116 - DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of buildings and site improvements.
 - 2. Removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and removing site utilities.
 - 4. Salvaging items for reuse by Owner.

1.2 DEFINITIONS

- A. Demolish: Completely remove and legally dispose of off-site.
- B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.
- C. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 SUBMITTALS

- A. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.6 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Owner assumes no responsibility for buildings and structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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- C. Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.
- D. On-site storage or sale of removed items or materials is not permitted.

1.7 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Division 3 "Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Cut off pipe or conduit a minimum of below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 "Temporary Facilities and Controls."
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.

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3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated existing buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain fire watch during flame cutting operations.
 3. Maintain adequate ventilation when using cutting torches.
 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be salvaged are indicated on Drawings.
- D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.
- E. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 1. Remove below-grade construction, including basements, foundation walls, and footings.
- F. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
- G. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earthwork."
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.10 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION

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SECTION 03 30 00 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures
 - 5. Vapor retarders
 - 6. Curing materials
 - 7. Floor and slab treatments
 - 8. Bonding agents
 - 9. Adhesives.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures
 - 5. Vapor retarders
 - 6. Curing materials
 - 7. Floor and slab treatments
 - 8. Bonding agents
 - 9. Adhesives.

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10. Epoxy joint filler.
11. Joint-filler strips.
12. Repair materials.

G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the 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-1.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60 deformed.
- B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete 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 or CRSI Class 2 stainless-steel bar supports.

- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.

- B. Portland Cement: ASTM C 150, Type V.

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

- C. Normal-Weight Aggregate: ASTM C 33, uniformly graded:

- D. Water: Potable and complying with ASTM C 94.

2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

- B. Air-Entraining Admixture: ASTM C 260.

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

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

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

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

2.5 VAPOR RETARDERS

- A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

- B. 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 No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

- C. 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 sieve and 0 to 5 percent passing a No. 8 sieve.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

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- C. Water: Potable.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.8 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Combined Fly Ash and Pozzolan: 25 percent.
- E. Maximum Water-Cementitious Materials Ratio: 0.55 for concrete required for foundations.
- F. Maximum Water-Cementitious Materials Ratio: 0.45 for slabs on grade.
- G. Maximum Water-Cementitious Materials Ratio: 0.50 for all other concrete.
- H. Air Content Non-Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- I. Air Content Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1 percent, unless otherwise indicated:
 - 1. Air Content: 5.5 percent for 1-1/2-inch- nominal maximum aggregate size.
 - 2. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.
- J. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

- K. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- L. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 2. 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.

2.9 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301.

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.

3.3 REMOVING FORMS

- A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" 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.

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- 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 fabric 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. 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. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/4-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface. Do not wait overnight before cutting joints.
- C. 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.
- D. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 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.
- C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Do not use vibrators to transport concrete inside forms.
- D. 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, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1.

F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. 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 restraighening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first trowel finish 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 and to floor and slab surfaces 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 tolerances noted on drawings, measured within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface.

D. 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.

3.10 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 Work.

3.11 CONCRETE PROTECTION AND CURING

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- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. 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 by one or a combination of the following methods:
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
 - 3. 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.
 - 4. 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.

3.12 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 sieve, using only enough water for handling and placing.

- 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 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 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 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 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix 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 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.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

- B. Testing Services: 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 mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

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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 mix. 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 mix.
 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 mix.
 6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of laboratory-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.
- D. Strength of each concrete mix 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.
- E. 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 03 30 00

SECTION 03 30 01 – CAST IN PLACE CONCRETE (SITE WORK)

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 SUBMITTALS

- A. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- B. 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.
- C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.4 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 94 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.

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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. 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.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Water-stops: Store water-stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.7 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with 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 for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 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.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents: ACI 301, ACI 117.

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.
 - 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. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled 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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 inch by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. 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.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. 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 to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 420, deformed.
- B. Plain-Steel Wire: ASTM A 82,.
- C. Deformed-Steel Wire: ASTM A 496.
- D. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

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- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. 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.

2.5 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.
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, uniformly graded.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. 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.
 - 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.
- F. 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.
- G. 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.

2.6 FIBER

- A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.
- B. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 long.
- C. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 long.

2.7 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- 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 sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

2.10 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. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

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1. Fly Ash: 25 percent.
 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 3. 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.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or retarding admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. 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.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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. Construct forms tight enough to prevent loss of concrete mortar.
- D. 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.

- E. 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.
- F. 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.
- G. Chamfer exterior corners and edges of permanently exposed concrete where shown.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. 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.

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 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 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.

3.4 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" 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. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.6 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. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 2. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 4. Use epoxy-bonding adhesive 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. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- 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.

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2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealant," 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.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 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 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 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 for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 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 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.

3.8 FINISHING FORMED SURFACES

- A. 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.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. 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 straightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated.
- C. 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.

3.10 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.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. 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 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. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - 3. 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.
4. 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.

3.12 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(s). 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 semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace, to the nearest scoring and/or joints, 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 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 in any dimension in solid concrete, but not less than 1 inch 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 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 remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch 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.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to the nearest scoring and/or joints and expose steel reinforcement with at least a 3/4-inch 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.
 6. Repair random cracks and single holes 1 inch 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.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: A qualified testing and inspecting agency will be engaged to perform field tests and inspections and prepare test reports. Testing agency will be engaged as outlined in the Special Provisions.
- B. 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., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - 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.

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3. 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.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; 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.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample, as directed by testing agency.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. 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.
9. 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.
10. 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.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. 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.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 01

SECTION 04 21 00 - ARCHITECTURAL CONCRETE MASONRY

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. Scope: Provide all labor, materials, equipment and services required to furnish and place the masonry work.
- B. This Section includes the following:
 - 1. Standard Concrete Masonry Units
 - 2. Decorative Concrete Masonry Units
 - 3. Mortar and Grout for Concrete Masonry Units
- C. Related sections include the following:
 - 1. Division 04 Section "Structural Concrete Masonry".
 - 2. Division 04 Section "Glass Unit Masonry".
 - 3. Division 04 Section "Architectural Precast Concrete".
 - 4. Division 07 Section "Water Repellents".
 - 5. Division 07 Section "Thermal Insulation".
 - 6. Division 07 Section "Sheet Metal Flashing and Trim".
 - 7. Division 09 Section "Painting".

1.3 DEFINITIONS

- A. CMU(s): Concrete Unit Masonry
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

- A. Prior to manufacturing, submit to the Architect for review the following:
 - 1. Product data: Submit manufacturer's specifications and other data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Include instructions for handling, storage, installations and protection.
 - 2. Samples for Verification: For each type and color of the following:
 - a. Decorative CMUs, in the form of small-scale units.
 - b. Colored Mortar.

1.5 QUALITY ASSURANCE

- A. Comply with requirements for materials and installation established by governing authorities for the construction and fire-resistance rating indicated.
 - 1. 2 hr. concrete unit masonry: ASTM Classification D-2.

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2. 3 hr. concrete unit masonry: ASTM Classification C-3.
 3. 4 hr. concrete unit masonry: ASTM Classification B-4.
- B. Comply with all pertinent codes and regulations.
- C. Qualifications of workmen:
1. For the actual cutting and placing of concrete masonry units, use only skilled journeyman masons who are thoroughly experienced with the materials and methods specified and thoroughly familiar with the design requirements.
 2. In acceptance or rejection of installed concrete masonry units, no allowance will be made for lack of skill on the part of workmen.
 3. Provide at least one skilled journeyman mason who shall be present at all times during execution of the work of this Section and who shall personally direct the execution of this portion of the Work.
- D. Tolerance for construction:
1. Variation from the plumb in the lines and surfaces of columns, walls and arises shall not exceed 1/8" in 10'-0" and 1/4" in a story height or 20'-0" maximum. Variation from plumb for external corners, expansion joints and other conspicuous lines, shall not exceed 1/4" in any story or 20'-0" maximum.
 2. Variation from the level of the grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines shall not exceed 1/4" in any bay or module or 20'-0", (whichever dimension is the least) nor 1/2" in 40'-0" or more.
 3. Variation of the linear building line from an established position in plan and related portion of columns, walls and partitions shall not exceed 1/4" in any bay or module or 20'-0", (whichever dimension is the least) nor 1/2" in 40'-0" or more.
 4. Variation in cross-sectional dimensions of columns and thickness of walls shall not exceed minus 1/4", nor plus 1/2" from the dimensions indicated on the Drawings.

1.6 JOB CONDITIONS

- A. Protection of work: During erection, cover top of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
1. Extend cover a minimum of 24" down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
- C. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
- D. Staining: Prevent grout or mortar from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges and projections from droppings of mortar.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

E. Cold weather protection:

1. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
2. Remove all masonry determined to be frozen or damaged by freezing conditions.
3. Perform the following protections for completed masonry and masonry not being worked on:
 - a. When the mean daily air temperature is from 40 degree F to 32 degree F, protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
 - b. When the mean daily air temperature is from 32 degree F to 25 degree F, completely cover masonry with weather-resistive membrane for at least 24 hours.
 - c. When the mean daily air temperature is from 25 degree F to 20 degree F, completely cover masonry with insulating blankets or similar protection for at least 24 hours.
 - d. When the mean daily air temperature is from 20 degree F and below, maintain masonry temperature above 32 degree F for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps, or other acceptable methods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

2.2 CONCRETE MASONRY UNITS (CMU)

- A. 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.
1. Acceptable Manufacturers:
 - a. Georgia Masonry Supply, a division of Oldcastle company (Basis of Design)
 - b. Headwater Construction Materials.
 - c. New Holland Concrete.
 - d. Lee Brick and Block.
- B. Standard CMUs: ASTM C-90
1. Physical Properties:
 - a. Size: Manufactured to dimensions less than nominal dimensions.
 - b. Color: Grey Block
 - c. See Division 04 Section "Structural Concrete Masonry" for strength and density classification.

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C. Decorative CMUs: ASTM C-90

1. Physical Properties:

- a. Apply the following Pattern and Texture as indicated by drawings or selected by the Architect:
 - 1) Split face.
 - 2) Scored, split face.
 - 3) Smooth face.
 - 4) Scored, smooth face.
- b. Color: As selected and verified by the Architect
- c. See Division 04 Section "Structural Concrete Masonry" for strength and density classification.

D. Special shapes:

- 1. Provide where required for lintels, corners, jambs, sills, sash, control joints, headers, bonding, coping unit and other special units for special conditions.
- 2. Provide special sill shape; size, shape and type as indicated in drawings.

E. Hollow load bearing CMU: Units shall conform to ASTM C90-75, grade N-I.

F. Solid load bearing CMU: ASTM C90, grade N-1.

G. Weight:

- 1. Refer to Division 4 Section "Structural Concrete Masonry" for structural CMU.
- 2. Lightweight units for interior non-bearing wall: Conform to ASTM C331-81. Dry net unit weight shall not less than 105 lbs./cu.ft. per ASTM C-90

H. Materials in exposed surfaces shall be free of chips, cracks or other imperfections.

I. Admix for block:

- 1. Product/manufacturer:
 - a. Acme Shield Integral Water Repellency System
 - b. W. R. Grace Dry-Block.
 - c. Krete" by Krete Industries
 - d. Blocktite" by Euclid Chemical Company
- 2. The addition of this admix is to achieve water repellency. Make addition of admix at the block plant, under the direction and approval of the manufacturer.

2.3 MORTAR

A. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

B. Materials:

- 1. Portland cement: ASTM C150-81, type 1.

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2. Masonry cement: ASTM C91-78, packaged cement.
 3. Sand: Natural siliceous sand conforming to ASTM C144-81.
 4. Water: Potable.
- C. Produced in accordance with ASTM C1329 for the preparation of ASTM C270 of the following types:
1. Type S: All structural load-bearing wall above grade (exterior and interior). Type S mortar shall be one half part portland cement, one part masonry cement, and four parts sand by volume.
 2. Type N: Non-load-bearing above grade walls only (exterior and interior). Type N mortar shall be one part masonry cement and three parts sand by volume.
 3. Type M: All below grade wall (load-bearing and non-load-bearing) and horizontal applications (pavement etc). Type M mortar shall be one part portland cement, one part masonry cement, and five parts sand by volume.
- D. Unless specifically noted otherwise, no admixtures will be permitted.
- E. Retempering will be allowed only as necessary to maintain flow.
- F. Use no mortar more than two hours old.
- G. Color of mortar:
1. Match adjacent CMU.
 2. Color shall be of the non-fading type.
- H. Water-Repellant Admixture: Nonchloride, noncorrosive, waterproofing admixture complying with ASTM C 494 and recommended by manufacturer for use in mortar and grout of composition indicated.
1. Available Products:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; Color Cure Mortar Admix.

2.4 GROUT FOR BOND BEAMS, CORE FILLING, AND REINFORCED MASONRY

- A. One part Portland cement, three parts sand by volume. Where grout is required to be poured, add sufficient water to form a thick fluid. Shall meet or exceed ASTM C-476-80.
- B. Aggregate for grout: ASTM C404-76, size no. 8.

2.5 CONTINUOUS WIRE REINFORCEMENT

- A. Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner and tee units. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross-rods, and a unit width of 1-1/2" to 2" less than thickness of wall or partition.
- B. Provide units fabricated as follows:

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1. Ladder type fabricated with single pair of 9 ga. side rods and 9 ga. perpendicular cross-rods spaced not more than 16" o.c.
2. Interior walls: Fabricate from galvanized wire, .40 oz per sq. ft., conforming to ASTM A641, Class 1.
3. Exterior walls: Hot-dip galvanized after fabrication with 1.5 oz. zinc coating, ASTM A153, Class B2 if exposed to moisture and/or weather; .80 oz. zinc coating, ASTM A641, Class 3 if completely embedded in mortar or grout.

2.6 REINFORCING BARS

- A. Deformed steel, ASTM A615, Grade 60.

2.7 INTERSECTING WALL ANCHOR

- A. Z-type rigid steel bar 1/4" x 1" x 24" with 3" i.d. bends. Hot-dip galvanized after fabrication.
- B. Install in alternate courses with horizontal wall reinforcing.
- C. Block cores into which the ties are placed shall be filled with grout.

2.8 TIES AND ANCHORS

- A. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Available Products:
 - a. Hohmann & Barnard, Inc.; DW-10 with VBT.
 - b. Heckmann Building Products Inc.; 315-D with 316.
 - c. Fero Corporation; Pac-Tie.
 2. Material:
 - a. Galvanized steel if ties are not embedded in grout.
 - b. Stainless steel if ties are embedded in grout.
 3. Anchor Section for connection to steel frame or structural sheathing: Channel slot to receive tie section, 14-ga with 5-inches vertical adjustment.
 4. Anchor Section for connection to masonry: Adjustable ties "pintles and eyes", 9-ga.
 5. Ties: Triangular-shaped wire tie, sized to extend not less than within 1 inch of masonry face, made from 0.188-inch-diameter.
 6. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel. Refer to Division 04 Section "Architectural Precast Concrete" for ties types and requirements.

2.9 MASONRY-CELL FILL INSULATION

- A. See Division 07 Section "Thermal Insulation". for cell fill insulation.

2.10 FLASHING

- A. See Division 07 Section "Sheet Metal Flashing and Trim" for concealed metal flashing.

2.11 PREMOLDED CONTROL JOINT STRIPS

- A. Solid rubber strips with a Shore A durometer hardness of 60 to 80, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration as indicated. Match color to adjacent CMU.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Carefully coordinate with all other Trades to ensure proper and adequate interface of the work of other Trades with the work of this Section.

3.2 GENERAL

- A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Cut masonry units with motor-driven saw designed to cut masonry with clean sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.
- D. Do not wet concrete masonry units.
- E. Frozen materials and work: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.
- F. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.
- G. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.

3.3 COURSING

- A. One concrete masonry unit plus one joint shall equal 8".
- B. All joints shall be 3/8", unless indicated otherwise.
- C. Pattern bond: Running bond (unless otherwise noted).

3.4 LAYING MASONRY - GENERAL

- A. Lay masonry plumb, true, and level.
- B. Lay masonry with full head and bed joints on surfaces joined, unless indicated otherwise.

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- C. Where vertical cells are filled with grout and reinforced, cells shall be aligned to provide clear openings. Cross webs adjacent to vertical cores which are to be filled with grout shall be fully bedded in mortar to prevent leakage of grout. Cut off face of blocks wherever splices occur to provide cleanout and inspection ports. When reinforcing bars have been installed, mortar in the new faces on cut block to match other block.
- D. Where thickness of concrete block diminishes, (e.g.: 8" block is set on 12" block) use solid top FHA blocks in top course of thicker portion of wall.
- E. Realignment of masonry shall not be permitted after a higher or following course has been laid. Any masonry which is disturbed after the mortar has stiffened shall be removed and re-laid with fresh mortar.
- F. When work has been stopped and about to resume again, rack back 1/2-masonry unit length in each course. Do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.
- G. Do not lay masonry when air temperature is below 40 degrees F, forecasted to go below 40 degrees F within 24 hours, or when it is raining.

3.5 BUILT-IN WORK

- A. As the work progresses, build-in items specified under this and other sections of these Specifications. Fill in solidly with masonry around built-in items.
- B. Fill space between hollow metal frames and masonry solidly with mortar.
- C. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

3.6 INTERSECTING LOAD-BEARING WALLS

- A. If carried up separately, block vertical joint with 8" maximum offsets and provide rigid steel anchors spaced not more than 4'-0" o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2'-0" o.c. vertically. If used with hollow masonry units, embed ends in mortar filled cores.

3.7 NON-BEARING INTERIOR PARTITION WALLS

- A. Build full height of story to underside of solid structure above, unless otherwise indicated.

3.8 MORTAR BEDDING AND JOINTING

- A. Mix in accordance with ASTM C270.
- B. Measure and batch materials either by volume or weight, such that the required proportions for mortar can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted.
- C. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar.
- D. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clean and free of deleterious materials which would impair the work. Do not use mortar which has begun to set, or if more than 2-1/2 hours has elapsed since initial mixing. Keep mortar tempered on the board. Re-tempering in mixer or in mortar box shall not be allowed.

- E. Lay masonry units with completely filled bed, head and collar joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
- F. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.
- G. Joints (unless otherwise indicated):
 - 1. Maintain joint widths except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints.
 - 2. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
 - 3. Tooling:
 - a. Standard block: Tool exposed joints slightly concave.
 - b. Scored block: Tool exposed joints slightly concave. Fill the score in the block to mimic standard block joint.
 - 4. Rake out mortar in preparation for application of caulking or sealants where shown.
- H. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.9 CONTINUOUS HORIZONTAL JOINT REINFORCING

- A. Provide continuous horizontal joint reinforcing. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcements a minimum of 6" at ends of units. Do not bridge control and expansion joints with reinforcing, unless otherwise indicated. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- B. Space continuous horizontal reinforcing 16" o.c. vertically unless, otherwise indicated.
- C. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8" apart, both immediately above the lintel and below the sill. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

3.10 LINTELS

- A. Install loose lintels of steel and other materials where shown.
- B. Provide masonry lintels where shown and wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
- C. For hollow concrete masonry unit walls, use specially formed "U"-shaped lintel units with reinforcing bars placed as shown and filled with grout.

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- D. Provide minimum bearing at each jamb, of 4" for openings less than 6'-0" wide, and 8" for wider openings.
- E. Openings in 6" through 12" thick wall: Erect adequate work to support masonry over openings. Keep in place until grout in bond beam lintels has set sufficiently to support the load. Set concrete masonry units in mortar. Lay so that all concrete lintels may be poured in one operation.
- F. Lay regular course of masonry overhead and reinforce next joint with joint reinforcing equal in length to rods specified above.

3.11 ANCHOR BOLT

- A. Unless noted otherwise, anchor-bolt must be embedded not less than 4-inches into bondbeam.

3.12 CONTROL AND EXPANSION JOINTS

- A. Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related masonry accessory items as the masonry work progresses.
- B. See Division 07 for sealants.
- C. Build-in joint fillers where shown, specified in a Division 7 Section.
- D. Control joints:
 - 1. Provide vertical control joints in all masonry walls that exceed 40'-0" in length and/or exceed a ratio of panel length to height (L/H) of 3. These joints shall be placed at the following locations:
 - a. Changes in wall height or thickness.
 - b. At construction joints in foundation, in roof, and in floors.
 - c. At chases and recesses for piping, columns, fixtures, etc.
 - d. At abutment of wall and columns.
 - e. At return angles in "L", "T", and "U" shaped structures.
 - f. At other locations designated on the Drawings.
 - 2. All joint locations must be verified and approved by the Architect.
 - 3. Create control joints with the use of the control joint gasket, backer rod and sealant. The gasket shall run continuous throughout the full height of the wall.

3.13 FLASHING

- A. Exposed metal flashing:
 - 1. Metal flashings shall be installed in strict accordance with the Architectural Sheet Metal Manual of the Sheet Metal and Air Conditioning Contractors National Association, Inc.
 - 2. Interlock end joints of deformed metal flashings by overlapping deformations not less than 1-1/2" and seal lap with elastic sealant.
- B. Concealed flashing:
 - 1. Provide concealed flashings in masonry work at, or above, all shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such

water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar. Seal penetrations, laps, and edges in flashing with mastic before covering the mortar.

2. Extend flashings the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from a line 1/2" in from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2".
 3. Install flashings in accordance with manufacturer's instructions.
- C. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

3.14 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.
- C. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

END OF SECTION 04 21 00

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SECTION 04 22 00 – STRUCTURAL CONCRETE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes structural concrete masonry assemblies consisting of the following:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.
- B. Related Sections include the following:
 - 1. All Division 4 Sections.
 - 2. Division 7 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
 - 4. Dovetail slots for masonry anchors, installed under Division 3 Section "Cast-in-Place Concrete."
 - 5. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."
 - 6. Other Division 4 masonry specifications.
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'_m) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- B. Provide unit masonry that develops the following net-area compressive strengths (f'_m) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.
 - 1. For Concrete Unit Masonry: $f'_m = 1500$ psi

1.5 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Verification: For the following:
 - 1. Accessories embedded in the masonry.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Mortar complying with property requirements of ASTM C 270.
 - 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 4. Each material and grade indicated for reinforcing bars.
 - 5. Each type and size of joint reinforcement.
 - 6. Each type and size of anchor, tie, and metal accessory.

- G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548. See plans for testing requirements.
- B. 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, through one source from a single manufacturer for each product required.
- C. 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.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - 2. Prism Test: For each type of wall construction indicated, per ASTM C1314.
 - 3. Mortar Test: For mortar properties per ASTM C 270.
 - 4. Grout Test: For compressive strength per ASTM C 1019.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
 - 2. Clean exposed faces of panels with masonry cleaner indicated.
 - 3. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
 - 4. Protect approved sample panels from the elements with weather-resistant membrane.
 - 5. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.
 - 7. Demolish and remove sample panels when directed.

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- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - 1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 - 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners, unless otherwise indicated.
 - 3. Provide square-edged units for outside corners, unless indicated as bullnose.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Medium weight, unless otherwise indicated.
 - 3. Provide Type I, moisture-controlled units.
 - 4. Size (Width): Manufactured to the following dimensions:
 - a. 8 inches nominal; 7-5/8 inches actual.
 - b. 12 inches nominal; 11-5/8 inches actual.
 - 5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- C. Mortar Cement: ASTM C 1329.
- D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

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- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- H. Water: Potable.

2.3 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).
- B. Epoxy-Coated Reinforcing Steel: ASTM A 615/A 615M, Grade 60 (Grade 400); epoxy coated to comply with ASTM A 775/A 775M.

2.4 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows: See related masonry specifications.

2.5 TIES AND ANCHORS, GENERAL: See related masonry specifications.

2.6 BENT WIRE TIES: See related masonry specifications.

2.7 ANCHORS FOR CONNECTING TO CONCRETE: See related masonry specifications.

2.8 RIGID ANCHORS: See related masonry specifications.

2.9 MISCELLANEOUS ANCHORS: See related masonry specifications.

2.10 EMBEDDED FLASHING MATERIALS: See related masonry specifications.

2.11 MISCELLANEOUS MASONRY ACCESSORIES: See related masonry specifications.

2.12 MASONRY-CELL INSULATION: Do not install in reinforced cores.

2.13 MASONRY CLEANERS: See related masonry specifications.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 - 1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 2. For structural masonry and where indicated, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

2.15 SOURCE QUALITY CONTROL

- A. A qualified independent testing agency as outlined in Div I shall perform source quality-control testing as shown on the drawings.:
 - 1. Any retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet or 1/2 inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inches, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.7 CAVITIES: See related masonry specifications.

3.8 MASONRY-CELL INSULATION: See related masonry specifications.

- A. Do not use in any cell requiring grout.

3.9 MASONRY JOINT REINFORCEMENT: See related masonry specifications.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated on the architectural drawings. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

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- C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
 - 1. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by the same method used for concrete masonry units.
 - 2. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
 - 3. Provide either of above at Contractor's option or provide precast or formed-in-place concrete lintels complying with requirements in Division 3 Section "Cast-in-Place Concrete."
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND VENTS: See related masonry specifications.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.15 FIELD QUALITY CONTROL

- A. A qualified independent testing agency, as outlined in Div. 1, shall perform field quality-control testing in accordance with ACI 530 - Table 1.14.1.2 – Level 2, Quality Assurance.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.
 - 8. Clean limestone units to comply with recommendations in the Indiana Limestone Institute of America's "Indiana Limestone Handbook."

3.15 MASONRY WASTE DISPOSAL: See related masonry specifications.

END OF SECTION 04 22 00

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SECTION 04 26 00 – ADHERED STONWORK VENEER SYSTEM

PART 1 - GENERAL

1.0 SUMMARY

- A. Scope of work - Provide veneer units, veneer installation materials and accessories as indicated on drawings, as specified herein, and as needed for complete and proper installation.
- B. Related Documents - provisions within General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings apply to this Section.

1.1 SECTION INCLUDES

- A. Stone veneer units
- B. Installation products; adhesives, mortars, pointing mortars, and sealants
- C. Air and water barrier/Waterproofing membranes

1.2 RELATED SECTIONS

- A. Section 03 30 00 Cast-in-Place Concrete
- B. Section 04 22 00 Concrete Unit Masonry

1.3 REFERENCE STANDARDS

- A. American Society For Testing And Materials (ASTM) C270 Standard Specification for Mortar for Unit Masonry
- B. International Organization for Standardization (ISO) 13007 Standards for Grouts and Adhesives
- C. Masonry Veneer Manufacturers Association (MVMA) Installation Guide for Adhered Concrete Masonry Veneer
- D. Tile Council Of North America (TCNA) Handbook For Ceramic, Glass, and Stone Tile Installation

1.4 SYSTEM DESCRIPTION

- A. Natural stone using latex-modified portland cement mortar and latex portland cement grout joints.

1.5 SUBMITTALS

- A. Submit shop drawings and manufacturers' product data under provisions of Section (01 33 00)
- B. Submit samples of each type/style/finish/size/color of natural stone, trim unit or threshold under provisions of Section (01 33 00)
- C. Submit manufacturers' installation instructions under provisions of Section (01 33 00)
- D. Submit proof of warranty.
- E. Submit Health Product Declarations (HPD) for each installation material.
- I. Submit Product Specific (Type III) Environmental Product Declarations for Cement Mortars for Tile Installation, Cement Grouts for Tile Installation, and/or Cement Self-Leveling Underlayments specified.
- J. Submit sample of installation system demonstrating compatibility/functional relationships between adhesives, mortars, grouts and other components under provision of Section (01 33 00) Submit proof from tile or stone manufacturer or supplier verifying suitability of tile or stone for specific application and use; including dimensional stability, water absorption,

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- freeze/thaw resistance (if applicable), resistance to thermal cycling, and other characteristics that the may project may require. These characteristics must be reviewed and approved by the project design professional(s).
- K. Submit list from manufacturer of installation system/adhesive/mortar/grout identifying a minimum of three (3) similar projects, each with a minimum of ten (10) years service.
 - L. For alternate materials, at least thirty (30) days before bid date submit independent laboratory test results confirming compliance with specifications listed in Part 2 - Products.

1.6 QUALITY ASSURANCE

- A. Natural stone Fabricator (single source responsibility): Company specializing in natural stone, trim units and/or thresholds with three (3) years minimum experience. Obtain tile from a single source with resources to provide products of consistent quality in appearance and physical properties.
- B. Installation System Manufacturer (single source responsibility): Company specializing in adhesives, mortars, grouts and other installation materials with ten (10) years minimum experience and ISO 9001-2008 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.
- C. Submit laboratory confirmation of adhesives, mortars, grouts and other installation materials:
 - 1. Identify proper usage of specified materials using positive analytical method.
 - 2. Identify compatibility of specified materials using positive analytical method.
 - 3. Identify proper color matching of specified materials using a positive analytical method.
- D. Installer qualifications: company specializing in installation of natural stone, trim units and thresholds with five (5) years documented experience with installations of similar scope, materials and design.

1.7 MOCK-UPS

- A. Provide mock-up of each type/style/finish/size/color of natural stone, trim unit and threshold, along with respective installation adhesives, mortars, grouts and other installation materials, under provisions of Section (01400)

1.8 PRE-INSTALLATION CONFERENCE

Pre-installation conference: At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of owner, architect, general contractor, tile subcontractor, Tile Manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at Site: deliver and store packaged materials in original containers with seals unbroken and labels, including grade seal, intact until time of use, in accordance with manufacturer's instructions.
- B. Store natural stone and installation system materials in a dry location; handle in a manner to prevent chipping, breakage, and contamination.
- C. Protect latex additives, organic adhesives, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.

- D. Store portland cement mortars and grouts in a dry location.

1.10 PROJECT/SITE CONDITIONS

- A. Provide ventilation and protection of environment as recommended by manufacturer.
- B. Prevent carbon dioxide damage to natural stone, trim, thresholds, as well as adhesives, mortars, grouts and other installation materials, by venting temporary heaters to the exterior.
- C. Maintain ambient temperatures not less than 50°F (10°C) or more than 100°F (38°C) during installation and for a minimum of seven (7) days after completion. Setting of portland cement is retarded by low temperatures. Protect work for extended period of time and from damage by other trades. Installation with latex portland cement mortars requires substrate, ambient and material temperatures at least 37°F (3°C). There should be no ice in slab. Freezing after installation will not damage latex portland cement mortars. Protect portland cement based mortars and grouts from direct sunlight, radiant heat, forced ventilation (heat & cold) and drafts until cured to prevent premature evaporation of moisture. Epoxy mortars and grouts require surface temperatures between 60°F (16°C) and 90°F (32°C) at time of installation. It is the General Contractor's responsibility to maintain temperature control.

1.11 SEQUENCING AND SCHEDULING

- A. Coordinate installation of stonework with related work.
- B. Proceed with stonework only after vents, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

1.12 WARRANTY

The manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written twenty five (25) year warranty, which covers materials and labor - reference LATICRETE Warranty Data Sheet 025.0 for complete details and requirements. For exterior facades over steel or wood framing, the manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written fifteen (15) year warranty, which covers replacement of LATICRETE products only – reference LATICRETE Warranty Data Sheet 230.15 for complete details and requirements.

PART 2 - PRODUCTS

2.0 NATURAL STONE

- A. Granite Veneer: Meet ASTM C615.
- B. Face Size: Random, Ashlar Pattern.
- C. Color Range, finish, as demonstrated on approved project site mockup

2.1 INSTALLATION MATERIALS MANUFACTURER

- A. Basis of Design: LATICRETE International, Inc., 1 Laticrete Park North, Bethany, CT 06524-3423 USA Phone 800-243-4788, (203) 393-0010 technicalservices@laticrete.com, www.laticrete.com; www.laticrete.com/green

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2.2 INSTALLATION ACCESSORIES – EXTERIOR ADHERED VENEER

- A. Waterproofing / Crack Suppression / Air & Water Barrier Membrane to be thin, cold applied, single component liquid and load bearing. Reinforcing fabric to be non-woven rot-proof specifically intended for waterproofing membrane. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured. It shall be certified by IAPMO and ICC approved as a shower pan liner and shall also meet the following physical requirements:

1. Hydrostatic Test (ASTM D4068):	Pass
2. Elongation @ break (ASTM D751):	20-30%
3. System Crack Resistance (ANSI A118.12):	Pass (High)
4. 7 day Tensile Strength (ANSI A118.10):	>265 psi (1.8 MPa)
5. 7 day Shear Bond Strength (ANSI A118.10)	>200 psi (1.4 MPa)
6. 28 Day Shear Bond Strength (ANSI A118.4):	>214 psi (1.48 – 2.4 MPa)
7. Service Rating (TCA/ASTM C627):	Extra Heavy
8. Total VOC Emissions:	< 0.22 mg/m ³

(Basis of Design: LATICRETE® MVIS™ Air & Water Barrier)

- B. Epoxy Waterproofing Membrane/Flashing Mortar to be 3 component epoxy, trowel applied specifically designed to be used under masonry veneer, stone or thin brick and requires only 24 hours prior to flood testing:

1. Breaking Strength (ANSI A118.10):	450-530 psi (3.1-3.6 MPa)
2. Waterproofness (ANSI A118.10):	No Water penetration
3. 7 day Shear Bond Strength (ANSI A118.10):	110-150 psi (0.8-1 MPa)
4. 28 Day Shear Bond Strength (ANSI A118.10):	90-120 psi (0.6–0.83 MPa)
5. 12 Week Shear Bond Strength (ANSI A118.10):	110-130 psi (0.8-0.9 MPa)
6. Total VOC Content:	<3.36 g/L

2.3 INSTALLATION MATERIALS – EXTERIOR ADHERED VENEER

- A. Latex Portland Cement Mortar for thick beds, and scratch/plaster coats to be weather, frost, shock resistant, non-flammable, UL GreenGuard Gold certified, and meet the following physical requirements:

1. Compressive Strength (ANSI A118.7 Modified):	>4000 psi (27.6 MPa)
2. Total VOC Emissions:	< 0.22 mg/m ³

(Basis of Design: LATICRETE MVIS™ Premium Mortar Bed)

- B. Latex Portland Cement Thin Bed Mortar for thin set to be weather, frost, shock resistant, non-flammable, UL GreenGuard Gold certified, and meet the following physical requirements:

1. Compressive strength (ASTM C270):	≥2900 psi (20 MPa)
2. Shear bond strength (ANSI A118.4 5.2.4):	≥300 psi (2.1 MPa)
3. Sag On Wall (EN 1308):	0.0mm
4. Total VOC Emissions:	≤0.22 mg/m ³

(Basis of Design: LATICRETE MVIS Hi-Bond Veneer Mortar)

- C. Expansion and Control Joint Sealant to be a one component, neutral cure, exterior grade silicone sealant and meet the following requirements:

1. Tensile Strength (ASTM C794):	280 psi (1.9 MPa)
2. Hardness (ASTM D751; Shore A):	25 (colored sealant) /15 (clear sealant)
3. Weather Resistance (QUV Weather-ometer):	10000 hours (no change)

(Basis of Design: LATICRETE MVIS Silicone Sealant)

PART 3 – EXECUTION**3.0 SUBSTRATE EXAMINATION**

- A. Verify that surfaces to be covered with stone, trim or waterproofing are:
1. Sound, rigid and conform to good design/engineering practices;
 2. Systems, including the framing system and panels, over which ceramic tile will be installed shall be in conformance with the International Residential Code (IRC) for residential applications, the International Building Code (IBC) for commercial applications, or applicable building codes.
 3. Clean and free of dust, dirt, oil, grease, sealers, curing compounds, laitance, efflorescence, form oil, loose plaster, paint, and scale;
 4. For thin-bed Ceramic tile installations when a cementitious bonding material will be used, including medium bed mortar: maximum allowable variation in the tile substrate – for tiles with edges shorter than 15" (375mm), maximum allowable variation is 1/4" in 10' (6mm in 3m) from the required plane, with no more than 1/16" variation in 12" (1.5mm variation in 300mm) when measured from the high points in the surface. For tiles with at least one edge 15" (375mm) in length, maximum allowable variation is 1/8" in 10' (3mm in 3m) from the required plane, with no more than 1/16" variation in 24" (1.5mm variation in 600mm) when measured from the high points in the surface. For modular substrate units, such as exterior glue plywood panels or adjacent concrete masonry units, adjacent edges cannot exceed 1/32" (0.8mm) difference in height. For thick bed (mortar bed) Ceramic tile and stone installations, and self-leveling methods; maximum allowable variation in the installation substrate to be (1/4" in 10' (6mm in 3m).
 5. To fully evacuate water, shower pan membranes and bonded waterproofing membranes in wet areas must slope to and connect with a drain. Plumbing code typically requires membranes to be sloped a minimum of 1/4" per ft. (6mm per 300mm) and extend at least 3" (75mm) above the height of the curb or threshold. Account for the perimeter floor height required to form adequate slopes. Membranes must be installed over the other horizontal surfaces in wet areas subject to deterioration, like shower seats. They must be sloped and configured so as to direct water to the membrane connected to the drain. The weep holes of clamping ring drains enable water to pass from the membrane into the plumbing system. Crushed Ceramic tile or stone, or other positive weep protectors, placed around/over weep holes help prevent their blockage. To form a watertight seal, membranes must have adequate contact with the clamping ring of the drain or with the bonding area of an integrated bonding flange.
 6. Not leveled with gypsum or asphalt based compounds
 7. For substrates scheduled to receive a waterproofing and/or crack isolation membrane, maximum amount of moisture in the concrete/mortar bed substrate should not exceed 5 lbs./1,000 ft² / 24 hours (283 µg/s·m²) per ASTM F1869 or 75% relative humidity as measured with moisture probes per ASTM F2170. Consult with finish materials manufacturer to determine the maximum allowable moisture content for substrates under their finished material. Please refer to LATICRETE TDS [183](#) "Drying of Concrete" and TDS [166](#) "LATICRETE and Moisture Vapor Emission Rate, Relative Humidity and Moisture Testing of Concrete", available at www.laticrete.com, for more information.
 8. Dry as per American Society for Testing and Materials (ASTM) D4263 "**Standard Test for Determining Moisture in Concrete by the Plastic Sheet Method.**"
- B. Concrete surfaces shall also be:
1. Cured a minimum of 28 days at 70°F (21°C), including an initial seven (7) day period of wet curing;
 2. Wood float finished, or better, if the installation is to be done by the thin bed method;
- C. Advise General Contractor and Architect of any surface or substrate conditions requiring correction before tile work commences. ***Beginning of work constitutes acceptance of substrate or surface conditions.***

3.1 INSTALLATION ACCESSORIES – EXTERIOR ADHERED VENEERS

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- A. Weather Resistant Barrier (WRB) or equivalent - 2 layers or as detailed and specified by project architect
1. Install as per WRB manufacturer's written installation instructions

B. Air and Water Barrier (exterior adhered veneers):

Install the vapor permeable air and water barrier in compliance with current revisions of manufacturer's written installation instructions. Review the installation and plan the application sequence. Pre-cut LATICRETE Waterproofing/Anti-Fracture Fabric (if required), allowing 2" (50mm) for overlap at ends and sides to fit the areas as required. Roll up the pieces for easy handling and placement. Shake or stir LATICRETE MVIS Air & Water Barrier before using.

Pre-Treat Cracks and Joints - Install sheathing panels and treat joints in accord with the respective sheathing panel manufacturer's installation instructions, including installation of board joint treatment. Pack any gaps around pipes, lights or other penetrations with LATAPOXY® Waterproof Flashing Mortar and allow to harden. Treat substrate joints and seams up to 1/8" (3 mm) by applying a liberal coat^ of LATICRETE MVIS Air & Water Barrier approximately 8" (200 mm) wide over seam using a paint roller (heavy napped), brush or trowel. While LATICRETE® MVIS™ Air & Water Barrier is still wet embed 6" (150 mm) wide LATICRETE Waterproofing/Anti-Fracture Fabric pressing the fabric in firmly so that the LATICRETE MVIS Air & Water Barrier liquid bleeds through the fabric, then immediately apply another liberal coat^ of LATICRETE MVIS Air & Water Barrier liquid over the fabric using a paint roller, brush or trowel. For substrate joints and seams greater than 1/8" (3 mm); fill seams to a smooth finish with a LATICRETE Polymer Fortified Veneer Mortar. Allow mortar to set 24 hours, then treat seams by applying a liberal coat^ of LATICRETE MVIS Air & Water Barrier approximately 8" (200 mm) wide over seam. While LATICRETE MVIS Air & Water Barrier is still wet embed 6" (150mm) wide LATICRETE Waterproofing/Anti-Fracture Fabric pressing the fabric in firmly so that the LATICRETE MVIS Air & Water Barrier liquid bleeds through the fabric, then immediately apply another liberal coat^ of LATICRETE MVIS Air & Water Barrier liquid over the fabric. LATICRETE MVIS Air & Water Barrier will dry to a uniform olive green color when it's dry to touch.

Pre-Treat Coves and Floor/Wall Intersections - Fill all substrate coves and floor/wall transitions to a smooth finish and changes in plane using a LATICRETE latex-fortified thin-set. Alternatively, a liberal coat* of LATICRETE MVIS Air & Water Barrier applied with a paint brush or trowel may be used to fill in cove joints and floor/wall transitions <1/8" (3mm) in width. Apply a liberal coat* of LATICRETE MVIS Air & Water Barrier approximately 8" (200mm) wide over substrate cracks, cold joints, and control joints using a paint brush or heavy napped paint roller.

Movement Joint Loop (Slip Joint) Treatment - Apply a liberal coat^ of LATICRETE MVIS Air & Water Barrier, approximately 8" (200 mm) wide over the areas. Then immediately embed and loop the 6" (152 mm) wide LATICRETE Waterproofing/Anti-Fracture Fabric into the substrate movement joint and allow to bleed through. Then top coat with a second liberal coat of LATICRETE MVIS Air & Water Barrier liquid fully encapsulating the LATICRETE Waterproofing/Anti-Fracture Fabric. Repeat process to ensure that all movement joints receive two (2) layers of LATICRETE Waterproofing/Anti-Fracture Fabric.

Main Application - Allow any pre-treated areas to dry to the touch. Apply a liberal coat^ of LATICRETE MVIS Air & Water Barrier using a paint roller (heavy napped) or paint brush over substrate including pre-treated areas and allow to dry to the touch approximately 1–2 hours at 70°F (21°C) and 50% RH. Apply a second liberal coat^ of LATICRETE MVIS Air & Water Barrier over the first coat of LATICRETE MVIS Air & Water Barrier. Let topcoat dry to the touch, approximately 1–2 hours at 70°F (21°C) and 50% RH. When last coat has dried to the touch, inspect final surface for pinholes, voids, thin spots or other defects and re-apply as necessary. LATICRETE MVIS Air & Water Barrier will dry to a uniform olive green color when it's dry to touch. Use additional LATICRETE MVIS Air & Water Barrier to seal pinholes, voids, thin spots or other defects and re-apply as necessary. Bring main application of LATICRETE Air and Water Barrier up to all penetrations through the membrane.

NOTE: Proper integration involves transitioning between different materials. LATAPOXY® Waterproof Flashing Mortar may be required between some connections, protrusions, details, joints and transitions. Where transitioning between different materials terminate the LATICRETE MVIS Air &

Water Barrier at the edge of the transition, allow main application to dry, then apply LATAPOXY Waterproof Flashing Mortar with a trowel overlapping both sides of the transition by at least 2" to 4" [50mm to 100mm] (see Illustration 1,2,4 & 7).

*** Dry coat thickness is 20 – 30 mil (0.02 - 0.03" or 0.5 - 0.8mm); consumption per coat is approximately 0.01 gal/ft² (approx. 0.4 L/m²); coverage is approximately 100 ft² /gal (approx. 2.5 m²/ L). LATICRETE Waterproofing/Anti-Fracture Fabric can be used to pre-treat cracks, joints, curves, corners, drains, and penetrations with LATICRETE MVIS Air & Water Barrier™.**

Spray Application of LATICRETE MVIS Air & Water Barrier - Follow all installation and surface preparation requirements outlined in this document and TDS 410M "Spraying LATICRETE MVIS Air & Water Barrier". The sprayer being used for the application of LATICRETE MVIS Air & Water Barrier should be capable of producing a maximum of 3300 psi (22.8 MPa) with a flow rate of 0.95 to 1.6 GPM (3.6 to 6.0 LPM) using a 0.521 or a 0.631 reversible tip. Keep the unit filled with LATICRETE MVIS Air & Water Barrier to ensure continuous application of liquid. The hose length should not exceed 100' (30 m) in length and 3/8" (10 mm) in diameter.

Apply a continuous LATICRETE® MVIS™ Air & Water Barrier film with an overlapping spray^*. The wet film has a sage green appearance and dries to a darker olive green color. When the first coat has dried to a uniform olive green color, approximately 45 to 90 minutes at 70°F (21 °C), visually inspect the coating for any voids or pinholes. Fill any defects with additional material and apply the second coat^* at right angles to the first. The wet film thickness should be checked periodically using a wet film gauge.

Check application thickness with a wet film gauge periodically as the LATICRETE MVIS Air & Water Barrier is being applied to ensure that the appropriate thickness and coverage is achieved. Bounce back and overspray will consume more product. To achieve the required film thickness, the coating must be free from pinholes and air bubbles. Bring main application of LATICRETE Air and Water Barrier up to all penetrations through the membrane. Do not back roll the spray applied coating. Allow the LATICRETE MVIS Air & Water Barrier to cure in accord with the instructions in this document and TDS 410M prior to the installation of finish materials. It is important to note that areas not scheduled to receive the LATICRETE MVIS Air & Water Barrier should be taped off and protected from any potential overspray.

Protection - Provide protection for newly installed membrane, even if covered with a thin-bed stone, masonry veneer, or thin brick installation against exposure to rain or other water for a minimum of 2 hours at 70°F (21 °C) and 50% RH. For temperatures between 45°F and 69°F (7 °C to 21 °C) allow a minimum 24 hour cure period.

Use the following LATICRETE System Materials:
LATICRETE MVIS Air & Water Barrier

References:
LATICRETE Data Sheets: [661.0](#), [661.5](#)
LATICRETE SDS: [Air & Water Barrier](#)
Health Product Declaration: [A&WB](#)
UL GreenGuard Gold Certificate: [A&WB](#)
LATICRETE Technical Data Sheets: [177M](#), [251](#), [410M](#)

3.2 INSTALLATION - EXTERIOR ADHERED VEENERS

- A. **Pre-float Method (exterior adhered veneers):** Over clean, dimensionally stable and sound concrete and masonry substrates, apply latex-portland cement thick-bed mortar as scratch/leveling coat in compliance with current revision of Masonry Veneer Manufacturer's Association (MVMA) "[Installation Guide for Adhered Concrete Masonry Veneer](#)" and/or veneer manufacturer's specific written installation instructions. Float surface of scratch/leveling coat plumb, true and allow mortar to set until firm. For installation of thin brick, masonry veneer, and stone, follow appropriate "**Exterior Adhered Veneers Method**" for "**Stacked Veneer**" or "**Pointed / Grouted**" veneer installations.

Use the following LATICRETE® System Materials:

LATICRETE MVIS™ Premium Mortar Bed

References:

LATICRETE Data Sheets: [263.0](#)

LATICRETE SDS: [Premium Mortar Bed](#)

Health Product Declaration: [Premium Mortar Bed HPD](#)

UL GREENGUARD GOLD Certificate: [Premium Mortar Bed](#)

- B. **Exterior Adhered Veneers (Stacked Veneer):** Moisten the back of each veneer unit and the top of the scratch coat so the surfaces appear damp but are free of standing water. Install masonry veneer adhesive mortar in compliance with current revisions of Natural Stone Veneer International (NSVI) "[Installation Guide for Natural Stone Veneer](#)" and/or veneer manufacturer's specific written installation instructions. Use the appropriate installation tools to ensure proper bedding of veneer unit. Work the masonry veneer adhesive mortar into good contact with the back of the veneer unit making sure the entire unit is buttered to a nominal 1/2" (12mm) thickness. DO NOT COVER JUST THE PERIMETER! Buttered masonry veneer units should be firmly worked onto the scratch coat and slid slightly back and forth or with a slight rotating motion. Allow installation to set until firm. Clean excess latex portland cement mortar from masonry veneer or stone face and joints between pieces. Tight fitted masonry veneer should be applied from the corners toward the middle of the wall, and from the bottom toward the top of the wall.

Use the following LATICRETE System Materials:

LATICRETE® MVIS™ Hi-Bond Veneer Mortar

References:

LATICRETE Data Sheet: [246.0](#)

LATICRETE SDS: [Hi-Bond Veneer Mortar](#)

Health Product Declaration (HPD): [Hi-Bond Veneer Mortar](#)

Product Specific (Type III) Environmental Product Declaration (EPD): [Cement Mortar EPD](#)

UL GREENGUARD Gold Certificate: [Hi-Bond Veneer Mortar](#)

LATICRETE Technical Data Sheets: [105](#), [126](#), [195](#), [251](#), [208](#)

- C. **Grouting or Pointing (Exterior Adhered Veneers):**

1. Pointing Mortar (for joints up to 1/2" (12mm): Allow thin brick, masonry, and stone installations to cure a minimum of 24 hours @ 70 °F (21 °C). Verify grout joints are free of dirt, debris or tile spacers. Sponge or wipe dust/dirt off veneer face and remove any water standing in joints. Surface temperature must be between 40-90 °F (4-32 °C). Use 2 quarts (1.9 L) of clean potable water for 25 lb. (11.4 kg) of LATICRETE® MVIS™ Premium Pointing Mortar. Place water in a clean mixing container and add mortar slowly. Mix with a slow speed mixer to a smooth stiff consistency. Allow mortar to slake for 5 minutes. Remix mortar. Pointing mortar/grout may be installed using a grout bag, filling the joints to the desired depth, ensuring the mortar is forced into all voids. The curing time will can vary significantly with temperature and humidity. Once applied allow to firm to "thumbprint" hardness, trowel, rake and/or dry, soft bristled brush to the desired finish.

Use the following LATICRETE System Materials:

LATICRETE MVIS Premium Pointing Mortar

References:

LATICRETE Data Sheets: [274.0](#)

LATICRETE SDS: [Premium Pointing](#)

Health Product Declaration: [Premium Pointing Mortar](#)

Environmental Product Declaration: [Grout EPD](#)

LATICRETE Technical Data Sheets: [201](#), [251](#), [400](#)

- D. **Waterproofing / Flashing:** To be designed and detailed by project architect / engineer. The function of wall flashing, or through-wall flashing, is to divert moisture which may penetrate the exterior face of the facade, or divert moisture which may condense within the wall from water vapor migration to or from the interior spaces. Flashings are commonly used at changes in configuration of the facade, and

- between different components of the wall. Typical locations requiring flashing are at the intersection of roof and wall assemblies, under roof parapet and wall copings, over window and door openings, under window sills, at shelf or relieving angles, and at bases of hollow or cavity walls. Flashings must always turn up against the area or material which is being protected in order to prevent water penetration. Provision must be made to divert any trapped water back to the outside and away from the face of the building facade. This is commonly done by placing weep holes, tubes or absorbent wicks from 24" – 33" (610 – 838mm) at the base of the flashing. Flashings must form a drip edge and extend a minimum of 3/8" (10mm) beyond the face of the facade to prevent water from dripping down the face of the facade. Check local building code for proper design, placement and implementation of flashing and weep systems. Copings, which protect the top of a parapet wall from water penetration, must be flashed, at a minimum, at the joints between the coping material (metal, stone, ceramic tile, pre-cast concrete), but preferably continuous along and beneath the entire length of the coping. Flashings which cannot be adhered or imbedded in the wall construction are either attached to reglets, which are pre-fabricated and pre-cast into the wall assembly, or attached to the wall assembly with mechanical attachments and sealed with sealants. In selecting a flashing, it is very important to verify compatibility of metals used in the window frame and the flashing in order to avoid corrosion from galvanic reactions of dissimilar metals.
- E. **Weeps / Pressure Equalization Vents:** To be designed and detailed by project architect / engineer. Most building codes permit weeps no less than 3/16" (5mm) in diameter and spaced no more than 33" (838mm) on-center. Wick and tube weep spacing recommended at no more than 16" (406mm) on-center. Install weeps and/or vent tubes through movement joints, conforming to the size, type and composition specified and as per weep/vent manufacturer's recommendations, on 24" (610mm) on-centers minimum, and at all locations indicated in shop drawings, plans and details. Ensure that all weeps and/or equalization tubes are properly placed to reach the waterproofing membrane and/or cavity they are designed to drain/vent, and are clear of dirt, debris, sealant or other obstructions.
- F. **Vapor Barrier:** Install vapor barrier, conforming to the type and composition specified and as per vapor barrier manufacturer's recommendations, on the side of wall cavity insulation that will be "warm in winter." Complete vapor barrier within two (2) weeks after enclosure of the building. Placement, composition and detail to be provided by project design professional.
- G. **Expansion and Control Joints:** Provide control or expansion joints as located in contract drawings and in full conformity, especially in width and depth, with architectural details.
1. Substrate joints must carry through, full width, to surface of tile, brick or stone.
 2. Install expansion joints in tile, brick or stone work over construction/cold joints or control joints in substrates.
 3. Install expansion joints where tile, brick or stone abut restraining surfaces (such as perimeter walls, curbs, columns), changes in plane and corners.
 4. Joint width and spacing depends on application - follow TCNA "**Handbook for Ceramic, Glass, and Stone Tile Installation**" Detail "EJ-171 Expansion Joints" or consult sealant manufacturer for recommendation based on project parameters.
 5. Joint width: $\geq \frac{1}{8}$ " (3mm) and ≤ 1 " (25mm).
 6. Joint width: depth ~2:1 but joint depth must be $\geq \frac{1}{8}$ " (3mm) and $\leq \frac{1}{2}$ " (12mm).
 7. Layout (field defined by joints): 1:1 length: width is optimum but must be $\leq 2:1$. Remove all contaminants and foreign material from joint spaces/surfaces, such as dirt, dust, oil, water, frost, setting/grouting materials, sealers and old sealant/backer. Use LATICRETE LATAFIL™ 9118 Primer for stainless steel, sandstone, metal, limestone (and other porous stones), PVC, fiber reinforced cement installations. Install appropriate backing material (e.g. closed cell backer rod) based on expansion joint design and as specified in section 07 92 00. Apply masking tape to face of tile, brick or stone veneer. Use caulking gun, or other applicator, to completely fill joints with sealant. Within 5-10 minutes of filling joint, "tool" sealant surface to a smooth finish. Remove masking tape immediately after tooling joint. Wipe excess sealant off all surfaces immediately.

Use the following LATICRETE® System Materials:

LATICRETE LATAFIL
LATAFIL 9118 Primer

References:

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LATICRETE Data Sheets: [6200.1](#), [6528.1](#)
LATICRETE SDS: [LATASIL](#), [Primer](#)
VOC Emission Testing: [Certificate](#), [Report](#)
LATICRETE Technical Data Sheets: [211](#), [251](#), [252](#)

K. **Sealer (Exterior Adhered Masonry Veneers):**

Read entire label before using. Use only as directed. Always test in a small inconspicuous area with a 24-hour cure time to determine ease of application and desired results. Allow new grout installations to cure for 72 hours prior to application. Make sure surface is clean and free of waxes and coatings. Sealer may be applied to damp surfaces one hour after standing water has been removed. Surface temperature is to be between 50°F and 80°F (10°C and 27°C). Ensure that the area is well-ventilated during application and until the surface is dry. Keep children and pets out of the area until treated surface is dry.

1. Mask off any surfaces not intended to be treated.
2. Liberally apply an even coat of STONETECH® Heavy Duty Exterior Sealer with a paint pad, paintbrush, paint roller or solvent-resistant, low-pressure sprayer. Do not use power sprayer. Do not thin before using. See method of application.
3. Allow sealer to penetrate the surface for 5–15 minutes; denser material may require more time for sealer to penetrate. During this time, distribute excess sealer over entire area to insure even penetration. DO NOT ALLOW EXCESS SEALER TO DRY ON THE SURFACE.
4. Thoroughly wipe dry the entire surface with a clean dry cloth to completely remove all excess sealer from the surface.
5. A second coat may be needed for porous, absorbent surfaces and should be applied one hour after initial application as directed in steps 2–4.
6. If sealer was not completely wiped off and a residue appears, wipe entire surface with a towel dampened with sealer. Use a white nylon pad to loosen residue and follow with a clean, white absorbent towel to remove.
7. Full cure is achieved in 24–72 hours. Surface use may resume in 4-6 hours.
8. Clean up promptly after job is complete, since rags and equipment that are wet with product may be combustible. Clean equipment with mineral spirits and allow equipment and rags to dry in a well-ventilated area out of reach of children and pets. After rags are dry, dispose of in accordance with local waste disposal regulations.

Recommended Surfaces: Brick; concrete / masonry; homogeneous granite; veined granite; unpolished, honed and textured limestone; quartzite, bluestone, sandstone, slate, and travertine

Storage and Handling Instructions: Avoid prolonged exposure to vapors. Use in a well-ventilated area. Do not ingest. Avoid contact with eyes and skin. KEEP OUT OF THE REACH OF CHILDREN. Do not freeze or store above 100°F (38°C). Do not mix with other chemicals. Do not release to natural waterways.

Use the following LATICRETE Systems Materials:
LATICRETE® STONETECH® Heavy Duty Exterior Sealer

References:
LATICRETE Data Sheets: [Heavy Duty Exterior Sealer](#)
LATICRETE SDS: [Heavy Duty Exterior Sealer](#)

- L. **Adjusting:** Correction of defective work for a period of one (1) year following substantial completion, return to job and correct all defective work. Defective work includes, without limitation, tiles broken in normal abuse due to deficiencies in setting bed, loose tiles or grout, and all other defects which may develop as a result of poor workmanship.

PART 4 – HEALTH AND SAFETY

The use of personal protection such as rubber gloves, suitable dust masks, safety glasses and industrial clothing is highly recommended. Discarded packaging, product wash and waste water should be disposed of as per local, state or federal regulations.

END OF SECTION 04 26 00

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SECTION 04 27 00 - GLASS UNIT MASONRY

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the glass unit masonry.
- B. This Section includes hollow glass block set in mortar.
- C. Related Sections include the following:
 - 1. Division 04 Section "Architectural Concrete Masonry".
 - 2. Division 07 Section "Joint Sealant".

1.3 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate completion of glass unit masonry assemblies so sealants can be installed immediately after mortar has attained final set.

1.4 SUBMITTALS

- A. Product data: Manufacturer's literature on each product to be used indicating compliance with requirements, including preparation instructions and recommendations, storage and handling requirements and recommendations, installation methods.
- B. Shop Drawings: Show fabrication and installation details for glass unit masonry, including vertical and horizontal coursing, anchors, reinforcement, and expansion strips.
- C. Samples for Verification:
 - 1. Two glass block units of each type specified, showing size, design and pattern of faces.
 - 2. Representative samples of panel reinforcing, panel anchors, expansion strips, sealant as required for project.

1.5 QUALITY ASSURANCE

- A. For placing units, use only skilled journey man masons who are thoroughly experienced with the materials and methods, specified and thoroughly familiar with the design requirements. In acceptance or rejection of installed concrete masonry units, no allowance will be made for lack of skill on the part of workmen.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

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- B. Protect opened cartons of glass block against windblown rain or water run-off with tarpaulins or plastic covering.
- C. Store glass-block grid materials in unopened cartons in an enclosed, dry location.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- F. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 JOB CONDITIONS

- A. Weather Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 41 deg F or higher.
 - 1. Maintain temperature in installation areas at 41 deg F or above for 48 hours after installing.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate completion of glass unit masonry assemblies so sealants can be installed immediately after mortar has attained final set.

1.9 WARRANTY

- A. Manufacturer shall provide a 5 year warranty on glass block units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis-of-design product.

2.2 GLASS BLOCK

- A. Hollow Glass Block: Hollow units made from transparent glass, with manufacturer's standard edge coating.
- B. Source Limitations for Glass Block: Obtain each type and pattern of glass block through one source from a single manufacturer.
- C. Product: Basis-of-Design is "Signature Line" series, "Essex-AA" pattern, as manufactured by Northeast Building Products

1. Acceptable Manufacturers:
 - a. Northeast Building Products (Basis-of-Design).
 - b. Mulia; Innovate Building Solutions.
 - c. Tafco Glassblock; International Product Supply.
 - d. WECK Glassblock; Seves.

D. Type:

1. Physical Properties:
2. Face Size: 4 inches by 8 inches by 8 inches, nominal. Actual face size is 1/4 inch (6 mm) less than nominal.
 - a. Thermal Resistance (R Value): 1.96 deg F hr sq ft/Btu (0.35 (K sq m)/W).
 - b. Visible Light Transmission: 45 percent.
 - c. Shading Coefficient: 0.45.
 - d. Sound Transmission (STC): 39
 - e. Solar Heat Gain Coefficient (SHGC): 0.66 – 0.68

2.3 MORTAR MATERIALS

- A. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- B. Portland Cement: ASTM C 150, Type I, natural color, or a blend to produce mortar color as selected by Architect.
 1. Where joints are indicated to be raked out and pointed, gray cement may be used for setting mortar.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement: ASTM C 91 for high strength use
- E. Water-Repellant Admixture: Nonchloride, noncorrosive, waterproofing admixture complying with ASTM C 494 and recommended by manufacturer for use in mortar and grout of composition indicated.
 1. Available Products:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; Color Cure Mortar Admix.

- F. Water: Potable.

2.4 GLASS UNIT MASONRY ACCESSORIES

- A. Source Limitations for Accessory Materials: Obtain each cementitious material, admixture and accessory component through one source from a single manufacturer and each aggregate from one source or producer.

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SECTION 04 27 00 – GLASS UNIT MASONRY

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- B. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless-steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.
- C. Sealants: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Division 7 Section "Joint Sealant."
 - 1. Single-component, neutral-curing silicone sealant.
- D. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing that comply with applicable requirements in Division 7 Section "Joint Sealant."

2.5 MORTAR MIXES

- A. Mortar shall be mixed and applied in accordance with the manufacturer's recommendations
- B. Mix mortar materials minimum 3 minutes with maximum amount of water to produce workable consistency in mechanical batch mixer, to comply with ASTM C270, 1 part masonry cement, 1/4 part Portland cement, 1/4 part lime, sand min. 2-1/4 part to max. 3 times volume of cement and lime.

2.6 SEALANT

- A. Tape surface of glass block using duct tape of similar material for uniform sealant appearance. Install backing rod in joint to required depth. Apply joint sealant to joint and tool concave. Remove tape after initial set has been achieved.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected and substrates have been properly prepared
 - 2. Verify that panel anchors or channels for support at head and jambs are properly installed as recommended by manufacturer.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by the manufacturer for achieving the best result for the substrate under the project condition.

3.3 INSTALLING GLASS BLOCK WITH MORTAR

- A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.

- B. Install in accordance with manufacturer's instruction with glass block set in full mortar bed with joint reinforcing at 16 inches on center and in joints immediately above and below openings.
- C. Keep expansion joints free of mortar.
- D. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
- E. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.
- F. Tolerance:
 - 1. Joint with: ¼" or to match that of CMU
 - 2. Variation from plane of unit to adjacent unit: max. 1/32".
 - 3. Variation from panel to plane: max. 1/16"

3.4 CLEANING

- A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.
- B. Remove excess sealants with commercial solvents of type recommended by sealant manufacturer. Exercise care not to damage sealant in joints.
- C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 04 27 00

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SECTION 04 72 00 - ARCHITECTURAL PRECAST 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.

1.2 SUMMARY

- A. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the architectural precast concrete.
- B. This Section includes, but not limited to the following:
 - 1. Architectural precast low wall cap.
 - 2. Architectural precast column and pilaster cap.
- C. Related Sections include the following:
 - 1. Division 04 Section "Architectural Concrete Masonry".
 - 2. Division 05 Section "Metal Fabrications".
 - 3. Division 07 Section "Water Repellents".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water absorption tests.
- C. 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 locations, extent, and treatment of dry joints if two-stage casting is proposed.
 - 5. Include plans and elevations showing unit location and sequence of erection for special conditions.
 - 6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 - 7. Indicate relationship of architectural precast concrete units to adjacent materials.
- D. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 4 by 4 by 2 inches.
- E. Material Test Reports: For aggregates.

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F. Material Certificates: For the following items, signed by manufacturers:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Design Standards:

1. Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Pre-stressed Concrete," applicable to types of architectural precast concrete units indicated.
2. Comply with detail recommendation of Cast Stone Institute® Technical Manual (Current Edition)

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. Samples: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample units, of actual size of each specified type of unit for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample units.

E. Mock-up: Prior to precast erection, construct in association with other trades whose materials are to be installed adjacent to or in conjunction with the precast, a sample mock-up.

1. Mock-up shall demonstrate aesthetic effects as well as quality of materials and execution. Demonstrate the proposed attachments system, sealant materials (in color selected by the Architect), damp-proofing and any associated finish material.
2. Provide all support and back-up materials for stabilization of the mock-up.
3. Other materials not specified as materials inherent to this Section shall be furnished and installed into the mock-up by other trades.
4. The entire approved mock-up shall remain for the duration of the construction and may be part or the construction upon approval by the Architect.

1.5 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 or other rehandling.

B. Support units during shipment on nonstaining shock-absorbing material.

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 manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Limestone: to the approval of the Architect.
 - 1. Color: white
 - 2. Finish of faces, edges and undersides: smooth
- B. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
- 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.
 - a. Gradation: Uniformly graded
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
- E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and non-fading.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- H. 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.

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2.2 GROUT MATERIALS

- A. 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.
- B. Nonmetallic, Nonshrink 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.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.3 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
- B. 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.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. 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.
- E. Normal-Weight Concrete Mixtures: Proportion mixtures 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.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- G. 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.
- H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.4 ACCESSORIES

- A. Anchors and dowels: Non-corrosive type, sized for conditions. Type 304 stainless steel.
 - 1. Size: 1/2 inch diameter by 8 inches long
 - 2. Location: 16 inches on centers and not more than 12 inches from each end.
- B. Precast Accessories: Provide steel lintels, shelf angles, clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units. Refer to Division 05 Section "Metal Fabrications" for compliance requirements.

- C. Sealant: ASTM C 920, low-modulus, multicomponent, nonsag urethane sealant complying with requirements in Division 07 Section "Joint Sealant" and that is nonstaining to stone substrate.
- D. Cleaner: Prosoco Sure Klean Custom Masonry Cleaner, Prosoco Sure Klean 600 Detergent, or Prosoco Sure Klean Vana Trol.

2.5 BEARING PADS

- A. Provide elastomeric bearing pads of vulcanized, chloroprene elastomeric compound which is molded to size or cut from a molded sheet. Bearing pads shall have a surface hardness of 50 to 70 Shore A durometer according to ASTM D-2214, minimum tensile strength 2250 psi per ASTM D-412.

2.6 FABRICATION

- A. 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."
- B. 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.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
- E. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- F. 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.
- G. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- I. 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.

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1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- J. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- K. 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.
- L. 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.
- M. 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.

2.7 FABRICATION TOLERANCES

- A. 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 PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.8 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 design reference sample and as follows:
 1. Design Reference Sample: smooth finish, no visible aggregate.
- B. Finish exposed top, bottom, and back surfaces of architectural precast concrete units to match face-surface finish.

2.9 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
- C. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Proceed with installation only after any unsatisfactory conditions have been corrected.
- B. Do not install precast units until the concrete has attained its design strength.
- C. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- D. 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. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 2. Unless otherwise indicated, provide for uniform joint widths of 3/8 inch.
- E. 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.
- F. At dowel connections, use stainless steel dowels, to prevent loosening or movement of units after final adjustment.
- G. Install clips, hangers, and other accessories required for the erection of precast units to supporting members and back materials.
- H. 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.
- I. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.2 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of precast concrete members.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. 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.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

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- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 REPAIRS

- A. Repair damaged 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.
- 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.

3.4 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.

END OF SECTION 04 72 00

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Architecturally exposed structural steel.
 - 3. Grout.
- B. Related Sections include the following:
 - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 5 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.

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.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: 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 number and spacing of shear stud connectors.
 - 5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

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6. 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.
 7. Do not reproduce contract documents for use as shop drawings.
 8. Shop drawings will not be reviewed by the Designer until after the General Contractor has thoroughly reviewed the shop drawings, verified existing conditions, and coordinated the shop drawings with other affected trades. Only three sets of marked up shop drawings shall be returned by the Designer.
- C. Welding certificates.
- D. Qualification Data: For fabricator .
- E. 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. Nonshrink grout.
- F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE CSE. Alternately, installer shall provide documentation of a minimum of five (5) years of experience of successful completion of projects of a similar size and complexity.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant. Alternatively, fabricator shall provide documentation of a minimum of seven (7) years of experience of successful completion of projects of a similar size and complexity.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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. 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.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Plain.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- D. Headed Anchor Bolts: ASTM F 1554, Grade 36.

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1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

- A. 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.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. No field fabrication of structural steel allowed. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 1. Mark and match-mark materials for field assembly.
 2. 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: Drill or punch standard 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 SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."
- F. 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: Drill or punch holes perpendicular to steel surfaces.

2.6 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: Pretensioned unless otherwise noted on drawings.

- 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. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. 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.

2.7 SHOP PRIMING

- 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 one of 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.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Where noted on drawings, apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - 1. Fill vent holes and grind smooth after galvanizing.
 - 2. Galvanize lintels and shelf angles located in exterior walls.

2.9 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."

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- D. Welded Connections: In addition to visual inspection, full pen 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.

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.

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--Allowable Stress Design and Plastic Design. "
- 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. Snug-tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 3. 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 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. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD 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: Pretensioned unless otherwise on drawings.
- 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--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 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.

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, full pen 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.

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- D. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:
 - 1. Shear connector stud welds will be visually inspected.
 - 2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
 - 3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to 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.

END OF SECTION 05 12 00

SECTION 05 50 00 - METAL FABRICATIONS

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the miscellaneous metal items.
- B. All items of miscellaneous metal work and related parts are not necessarily described. The most important and those requiring detailed description are usually mentioned. Provide all other work as indicated on the Drawings and/or necessary to complete the Contract, except for items which may be specifically excluded from the work of this Section.
- C. This Section includes the following:
 - 1. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Steel framing and support for steel tube swing gate and mounting supports.
 - 4. Shelf angles
 - 5. Loose Bearing and leveling plates
 - 6. Steel weld plates and angles for casting into concrete not specified in other Sections.
 - 7. Aluminum gates and fences.
 - 8. Partition head slip connection.
- D. Related Sections include the following:
 - 1. Division 09 Section "Painting".

1.3 SUBMITTALS

- A. Prior to installation, submit to the Architect for review the following:
 - 1. Shop drawings showing all locations, markings, quantities, materials, sizes, and shapes and indicate all methods of connecting, anchoring, fastening, bracing, and attaching to the work of other Trades.
 - 2. Prequalified welding procedures, prepared by the steel fabricator and erector, as a written procedure specification to the Architect. Prepare these procedures in accordance with Appendix E of the AWS Structural Welding Code.
 - 3. Written erection sequence and procedure to be used by steel erector.
 - 4. Mill certification that steel supplied meets requirements of specifications.
 - 5. Electrode manufacturer's certification that the electrode and flux combination meets the requirements of the particular classification or grade of electrodes.
 - 6. Certification that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 - 7. Certification that surface preparation has been completed in accordance with the instructions and recommendations of the paint or coating manufacturer.

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8. Shop primer: Complete manufacturer's literature fully describing the product, mill thickness and application.

1.4 QUALITY ASSURANCE

- A. In addition to complying with all pertinent codes and regulations, comply with:
 1. "Specification for Design, Fabrication, and Erection of Structural Steel for Building" of the American Institute of Steel Construction.
 2. "Code for Welding in Building Construction" of the American Welding Society.
 3. Manual of Steel Construction, 9th edition, Part 1 for types of steel required.
- B. Conflicting requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards of these Specifications, the provisions of the more stringent shall govern.
- C. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Structural Performance for Aluminum Tube Fence and Swing Gate: Provide railings / gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
Verify rails will support the following forces applied concurrently;
50 lbf/ft. applied horizontally with 80 lbf/ft applied vertically downward.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Uniform load of 80 lbf/sq. ft applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
 3. Non-Sag Support: Provide miscellaneous support to prevent gate from sagging, support as followed but not limited to:
 - a. Diagonal truss rod
 - b. Adequate hardware size and capacity

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack and store steel above ground on platforms, studs, or other supports. Protect steel from corrosion and damage. Keep materials clean.
- B. Store other materials in a weathertight, dry place until ready for use.
- C. Store packaged materials in their original, unbroken package or container.

1.6 JOB CONDITIONS

- A. Field measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS STEEL SHAPES

- A. ASTM A 36.
- B. For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 WELDING ELECTRODES

- A. Electrodes having low hydrogen covering shall be purchased in hermetically sealed containers.
- B. For fabricating plant use: E-70 electrodes, AWS A5.5, A5.17, and A5.20.
- C. For field use: E-70 electrodes, AWS A5.5, A5.17, and A5.20.

2.3 FASTENERS

- A. Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electro-deposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568, Property Class 4.6), with hex nuts, ASTM A563 (ASTM A563M), and, where indicated, flat washers.
- C. Machine screws: ANSI B18.6.3.
- D. Lag screws: ANSI BH18.2.1 (ANSI B18.2.3.8M).
- E. Wood screws: Flat head, carbon steel, ANSI B18.6.1.
- F. Plain washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M0).
- G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- H. Expansion anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
 - 1. Carbon steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Group 1 alloy 304 or 316 stainless-steel bolts and nuts comply with ASTM F593 (ASTM F738M) and ASTM F594 (ASTM F836M).

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- I. Toggle bolts: FS FF-B-588, tumble-wing type, class and style as required.
- J. Concrete anchors: Phillips Red Head, self-drilling anchors. Catalog No. S-38 with machine bolts and washers, or approved equivalent.

2.4 GROUT

- A. Nonshrink, metallic grout: Factory-packaged, ferrous-aggregate grout comply with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, nonmetallic grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior application.

2.5 FABRICATION

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles on surfaces and straight sharp edge.
- C. Exterior work: Allow for thermal movement resulting from change in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Shop assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 ROUGH HARDWARE

- A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work.

2.9 SHOP COAT

- A. Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors: SSPC-SP 6 "Commercial Blast Cleaning".
 - 2. Interiors: SSPC-SP 3 "Power Tool Cleaning".
- B. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Use only top quality, rust-inhibiting primer.
 - 1. Ensure that primer is compatible with finish, field paint. See Division 09 Section "Painting".

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2.10 GALVANIZING

- A. Any metal that has any surface or edge exposed to the weather shall be hot-dip galvanized after fabrication. All galvanized shall meet the requirements set forth in ASTM A 446-76 and ASTM A 525-80.

2.11 MANUFACTURED ITEMS:

- A. Manufactured items of types normally carried in stock inventories, as distinguished from items fabricated especially for this Project, shall be fabricated from materials customarily used by the manufacturer, irrespective of the requirements of this Specification, unless in particular instances, special materials shall be specified. With respect to shop prime coats of paint on such stocked items, manufacturer's standard finish will be accepted unless specified otherwise.

2.12 ALUMINUM SWING GATES

- A. General: Comply with ASTM F 900 for single and double swing gate types, as indicated in drawings.
 - 1. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes.
 - 2. Gate configuration, height and width: as indicated in drawings.
 - 3. Frame Members:
 - a. Tubing Size: square tubes for post, 1 3/4-inch square tube for gate upright, 3/4-in. square min. for pickets at 4 in. on center max. Provide decorative post cap for post and pickets, Architect to select from standard manufacturer's type. No exposed open tube ends.
 - b. Frame Support Construction: 3/8 inch diameter, adjustable truss rods for panels 5 feet wide or wider. 1 3/8-inch by 1 1/2-inch u-channel rail (top, bottom, intermediate).
 - c. Provide separate isolated gate frame according to ASTM F 1916 and as indicated.
 - d. Post: Continue post 36 in. below slab.
 - e. Separation between Hinge and Latch Post and Fence Termination Post: 2 inch minimum, 2 1/2 inch maximum.
- B. Hardware:
 - 1. Hinges: Offset type, 180-degree swing.
 - 2. Latch:
 - a. Padlock key: Fabricate latches with integral eye openings for padlocking; padlock accessible from inside.
 - b. Lockable latch: self-latching, lever handle (front and back), vandal resistant locking handle, dual key-locking cylinders, fit with specified gate frame.
 - 3. Drop rod: Stainless steel drop rod (304 series), 18-in. long, 5/8-in. diameter, dual guides and locking ears to prevent theft.
 - 4. Gate Stop: molded, reinforced polymer construction with rubber buffer.
 - 5. Fasteners: Manufacturer's standard concealed fastening system or corrosion-resistant color coated fasteners matching fence components.
- C. Finish:
 - 1. Powder Coat Finish: AAMA 2603.
 - 2. Color: Black

- D. Basis-of-Design: Subject to compliance with requirements, provide products by the following:
- a. “Colonial Aluminum Ornamental Fence” series by Master Halco
 - b. “Echelon Plus” series by Ameristar Fence Products.
 - c. Alumni-Guard, Inc.
 - d. Elite Fence Products, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorage, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, wood screws, and other connectors as necessitated.
- B. Cutting, fitting, and placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in from work for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field welding:
- 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- F. Corrosion protection: Protect concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a minimum layer of 3/8” neoprene sheet, washer, or plywood. Bituminous paint may be allowed in certain areas as approved by the Architect.

3.3 CONTINUOUS BENT PLATES

- A. Provide continuous single angles in long lengths where indicated or necessitated. Drill 1/2-inch holes for wood attachment at 24-inch o.c. where required.

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3.4 MISCELLANEOUS CLIP ANGLES AND BENT PLATES

- A. Provide as indicated or necessitated. Drill 1/2-inch holes for wood attachment at 24-inch o.c. where required.

3.5 LOOSE LINTELS

- A. Make loose lintels long enough to provide 8-inch of bearing on each end.
 - 1. Hot-dip galvanized.
 - 2. Provide loose lintels to the masonry trade for installation.

3.6 WELDING PLATES

- A. Fabricate plates of sizes indicated. Fabricate to have a minimum of two Nelson Studs on bottom side of plates. Use stud sizes indicated.

3.7 SHOP COAT

- A. Before steel leaves shop, remove loose mill scale, rust and foreign matter, and apply one coat of primer. Do not paint surfaces at places to be welded.

3.8 ERECTION

- A. Use only experienced welders qualified by American Welding Society prescribed testing.
- B. Miscellaneous angles, bent plates, and clip angles: Install as indicated.
- C. Bent plates at roof edges: Before welding plates to structural members, accurately align them so that wood members shall be installed on bent plates can be plumbed with face of brick. After bent plates are lined up, weld them securely in place.
- D. Welding plates: Install welding plates when concrete and bond beams are set. When concrete has begun to set, clean off tops of plates to assure clean welding surfaces.
- E. Steel plates: Install plates as indicated.
- F. Threaded anchor bolts: Have anchor bolts formed into slab as indicated.

3.9 CLEAN-UP

- A. When steel has been installed, clean up spatter and debris resulting from welding. Where welding is rough and may interfere with smooth laying of metal deck, grind welds.

3.10 TOUCH-UP PAINTING

- A. When steel has been installed, touch-up welds, scarred and abraded places on bent plates, structural steel and bar joists with rust-inhibiting paint. Ensure compatibility with finish, field paint. See Division 09 Section "Painting".

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

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. Steel pipe and tube railings.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast In Place Concrete" (Site Work).
 - 2. Division 09 Section "Painting"

1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 2. Steel: 72 percent of minimum yield strength.
- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction and concurrently with 100 lbf/ft. applied vertically downward.
 - b. Concentrated load of 300 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

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3. Infill of Guards:
 - a. Concentrated load of 200 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Uniform load of 50 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Manufacturer's product lines of mechanically connected railings.
 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. All permit drawings shall be stamped with a professional engineer's seal registered in the state of the building location.
- C. Samples for Selection: For products involving selection of color, texture, or design.
- D. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Steel Pipe and Tube Railings:
 - a. Pisor Industries, Inc.
 - b. Sharpe Products.
 - c. Wagner, R & B, Inc.; a division of the Wagner Companies.
 - d. Blum, Julius & Co., Inc.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

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2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.
- E. Expanded Metal: ASTM F 1267, Type I (expanded) or II (expanded and flattened), Class 1 (uncoated).

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 3. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide manufactured standard anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

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- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. As detailed.
 - 2. By bending.
 - 3. By flush bends.
- K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

- Q. For removable railing posts, fabricate slip-fit sockets from [steel] [stainless-steel] tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - 3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

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- F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 3. Interior Railings Indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Do not apply primer to galvanized surfaces.
 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
 - 1. Attached to post with set screws for section noted to be removable.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

SECTION 05 52 13 - TUBE AND PIPE RAILINGS

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- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wood framing.
 - 2. Wood supports.
 - 3. Wood blocking.
 - 4. Wood cants.
 - 5. Wood nailers.
 - 6. Wood furring.
 - 7. Wood grounds.
 - 8. Wood sheathing.
 - 9. Wood subflooring.
 - 10. Plywood backing panels.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product indicated.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.
- C. Research/Evaluation Reports: For the following:
 - 1. Treated wood.
 - 2. Engineered wood products
 - 3. Power-driven fasteners.
 - 4. Metal framing anchors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

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SECTION 06 10 00 – ROUGH CARPENTRY

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2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

- B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

- C. Wood Structural Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Oriented Strand Board: DOC PS 2.
 - 3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber.

- C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 18 inches (460 mm) above grade.
 - 4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.4 DIMENSION LUMBER

- A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Eastern softwoods; NELMA.
- C. Framing Other Than Non-Load-Bearing Partitions: No. 2 grade of any of the following species:
 - 1. Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - 2. Southern pine; SPIB.
- D. Exposed Framing: Hand select material for uniformity of appearance and freedom from characteristics that would impair finish appearance.
 - 1. Species and Grade: As indicated above for load-bearing construction of same type.

2.5 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Composite of wood veneers with grain primarily parallel to member lengths, manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
 - 1. Manufacturers:
 - a. Boise Cascade Corporation.
 - b. Weyerhaeuser TrusJoist Corporation
 - 2. Extreme Fiber Stress in Bending, Edgewise: 2400 psi for 12-inch nominal-depth members.
 - 3. Modulus of Elasticity, Edgewise: 2,000,000 psi .

2.6 SHEATHING

- A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

2.8 MISCELLANEOUS MATERIALS

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SECTION 06 10 00 – ROUGH CARPENTRY

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- A. Fasteners:
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. Power-Driven Fasteners: CABO NER-272.
 - 3. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

- B. Metal Framing Anchors: Made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Manufacturers:
 - a. Simpson Strong-Tie Company, Inc.
 - 2. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 - 3. Allowable Design Loads: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

- C. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds and similar supports to comply with requirements for attaching other construction.

- B. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven fasteners.
 - 2. Published requirements of metal framing anchor manufacturer.
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.

6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.
- D. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
- E. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- F. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- G. Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
 1. Comply with "Code Plus" provisions in above-referenced guide.
- H. Fastening Methods:
 1. Combination Subfloor-Underlayment: Glue and nail to wood framing.
 2. Subflooring: Glue and nail to wood framing.
 3. Sheathing: Nail to wood framing.
 4. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 06 10 00

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SECTION 06 10 00 – ROUGH CARPENTRY

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SECTION 06 10 00 - GENERAL CARPENTRY

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the rough and finish carpentry.
- B. This Section includes the following:
 - 1. Rough Carpentry:
 - a. Framing with dimension lumber.
 - b. Framing with engineered wood products.
 - c. Wood blocking, cants, and nailers.
 - d. Wood furring.
 - e. Wood sleepers.
 - f. Utility shelving.
 - g. Plywood backing panels.
 - 2. Finish Carpentry:
 - a. Trim board.
 - b. Perimeter trim at ceiling and soffit.
 - c. Batten board at panel joints.
 - d. Wood trim for casework.
 - e. All other exposed-to-view carpentry.
- C. Related Sections include the following:
 - 1. Division 06 Section "Sheathing".
 - 2. Division 06 Section "Metal Plate Connected Wood Trusses".
 - 3. Division 31 Section "Termite Control".

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

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1.4 REFERENCE

- A. American Plywood Association (APA); US Product Standard PS 1 for construction and Industrial Plywood
- B. American Society for Testing and Materials (ASTM); ASTM E84 for test method for surface burning characteristics of building materials.
- C. American Wood Preservers Association (AWPA): Refer to AWPA standard U1 (Sub-Section 6 for major commodity classifications) D. Federal specifications (EF):
 - 1. TT-W-550 for wood preservative, chromated copper arsenate mixture
 - 2. TT-W-571 for wood preservative; treating practices

1.5 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.
- C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Engineered wood products.
 - 4. Power-driven fasteners.
 - 5. Powder-actuated fasteners.
 - 6. Expansion anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground. Refer to AWWA standard U1 "Use Category System" for other items not listed.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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3. Water-borne preservatives shall comply with AWPB LP-2, LP-3, LP-4 and LP-22 as applicable. After treatment, kiln-dry to a maximum moisture content of 15%.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat the following:
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, tripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing, furring and sheathing attached directly or rest on exterior foundation walls (concrete or masonry) and are less than 8 inches from exposed earth.
 4. Wood framing members that are less than 18 inches (460 mm) above the exposed ground in crawlspaces or unexcavated areas.
 5. Wood framing members that are placed in water or exposed to wetting and corrosive environments.
 6. Wood framing members that would be susceptible to decay organisms or insects..
 7. Exterior walls below grade.
 8. Wood floor plates that are installed over concrete slabs-on-grade.
 9. Post and columns supporting permanent structures and supported and that in direct contact with the earth.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with firetest-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all wood structural framing members, other than type IV size.

2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent maximum at the time of permanent closing in of the structure.
- B. Interior Partitions: Construction or No. 2 grade of any species.
- C. Exterior and Load-Bearing Walls: Construction or No. 2 grade and the following species:
 1. Hem-fir (north); NLGA.
 2. Southern pine; SPIB.
 3. Douglas fir-larch; WCLIB or WWPA.
 4. Mixed southern pine; SPIB.
 5. Spruce-pine-fir; NLGA.
 6. Douglas fir-south; WWPA.
 7. Hem-fir; WCLIB or WWPA.
 8. Douglas fir-larch (north); NLGA.
 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- D. Ceiling Joists (Non-Load-Bearing): Construction or No. 2 grade and any of the following species:
 1. Hem-fir (north); NLGA.
 2. Southern pine; SPIB.
 3. Douglas fir-larch; WCLIB or WWPA.
 4. Douglas fir-larch (north); NLGA.
 5. Mixed southern pine; SPIB.
 6. Spruce-pine-fir; NLGA.
 7. Hem-fir; WCLIB or WWPA.
 8. Douglas fir-south; WWPA.
 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 10. Northern species; NLGA.
 11. Eastern softwoods; NeLMA.
 12. Western woods; WCLIB or WWPA.

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- E. Joists, Rafters, Girder Truss, Built-up Post/Beam, and Other Framing Not Listed Above: No. 2 grade and any of the following species:
 - 1. Southern pine; SPIB.
 - 2. Douglas fir-larch; WCLIB or WWPA.
- F. Exposed lumber shall have S4S surfacing

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. Refer to Division 06 Section "Millwork" for lumber and plywood used for casework.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content, provide construction or No.2, GM, SYP. Or KDAT.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- G. Provide lumber of sizes indicated, worked into shapes shown.

2.6 FINISH CARPENTRY

- A. All finish carpentry shall be Douglas fir, appearance grade.

2.7 PLYWOOD BACKING PANELS

- A. General: Refer to Division 06 Section "Sheathing" for finish grade plywood sheathing for wall and ceiling.
- B. Telephone and Electrical Equipment Backing Panels: 3/4" APA Marine Grade plywood, painted with two coats of non- conductive, painted, flat gray, fire-retardant treated and be 4' by 8' unless indicated otherwise.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.

- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
- K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 2. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally spaced as indicated in drawings.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically spaced as indicated in drawings.

SECTION 06 10 00 – GENERAL CARPENTRY

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3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction, unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) wood studs spaced as indicated in drawings.
 - 2. For interior partitions and walls, provide 2-by-4-inch nominal- (38-by-89-mm actual-) size wood studs spaced as indicated in drawings.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.
- D. Provide diagonal bracing in walls, at locations indicated, at 45-degree angle, full-story height, unless otherwise indicated.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19-by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.

2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.6 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

END OF SECTION 06 10 00

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SECTION 06 13 00 – HEAVY TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes framing using timbers.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for dimension lumber items associated with heavy timber construction.
 - 2. Division 6 Section "Wood Decking" for wood roof decking.
 - 3. Division 6 Section "Structural Glued-Laminated Timber" for glued-laminated timber.

1.3 DEFINITIONS

- A. Timbers: Lumber of 5 inches nominal or greater in least dimension.
- B. Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NHLA - National Hardwood Lumber Association.
 - 3. NLGA - National Lumber Grades Authority.
 - 4. SPIB - Southern Pine Inspection Bureau.
 - 5. WCLIB - West Coast Lumber Inspection Bureau.
 - 6. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For timber and timber connectors.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include installation instructions for timber connectors.

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- B. Shop Drawings: Show layout of heavy timber construction system, full dimensions of each member, and details of connections.
- C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance, including surface texture, of wood products. Apply a coat of penetrating sealer to samples.
- D. Material Certificates: For heavy timber construction specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.
- E. Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.

1.5 QUALITY ASSURANCE

- A. Timber Standard: Comply with AITC 108, "Standard for Heavy Timber Construction."
- B. Forest Certification: Provide timber obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2 "Principles and Criteria."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of heavy timber construction to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 HEAVY TIMBER, GENERAL

- A. General: Comply with DOC PS 20 and grading rules of lumber grading agencies certified by American Lumber Standards Committee Board of Review, as applicable.
 - 1. Factory mark each item of timber with grade stamp of grading agency.
 - 2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that will not be exposed to view or omit grade stamps and provide certificates of grade compliance issued by grading agency.
- B. Preservative Treatment:
 - 1. Pressure treat timber with waterborne preservative to comply with AWWA C15 requirements for "sawn building poles and posts as structural members."
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

- a. Ammoniacal, or amine, copper quat (ACQ).
 - b. Ammoniacal copper zinc arsenate (ACZA).
 - c. Chromated copper arsenate (CCA).
3. Use process that includes water-repellent treatment.
 4. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
 5. After treatment, redry timber to 19 percent maximum moisture content.
 6. Application: Treat items indicated on the Drawings.

2.2 TIMBER

- A. Timber Species and Grade: Douglas fir-larch, Douglas fir-larch (North), or Southern Pine; Select Structural, NELMA, NLGA, SPIB, WCLIB, or WWPA.
 1. Allowable Stress Ratings: As indicated on Drawings.
- B. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.
- C. Dressing: Provide dressed timber (S4S), unless otherwise indicated.
- D. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- E. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.3 TIMBER CONNECTORS

- A. General: Unless otherwise indicated, fabricate from the following materials:
 1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36.
- B. Provide bolts, 3/4 inch, unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.
- C. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.4 FABRICATION

- A. Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.
- B. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

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1. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
2. Where preservative treated members are indicated, fabricate (cutting, drilling, surfacing, and sanding) before treatment to the greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWWA M4.
 - a. Use inorganic boron treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- C. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Erect heavy timber construction true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 1. Install heavy timber construction to comply with Shop Drawings.
 2. Install horizontal and sloping members with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members, unless otherwise indicated; tie together over supports if not continuous.
 3. Handle and temporarily support heavy timber construction to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Fit members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.
- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
 1. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 2. Coat crosscuts with end sealer.
 3. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWWA M4.
 - a. Use inorganic boron treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. Install timber connectors as indicated.
 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.2 ADJUSTING AND CLEANING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber construction if repairs are not approved by Architect.

END OF SECTION 061300

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SECTION 06 15 00 - WOOD DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid wood decking.
- B. Related Sections include the following:
 - 1. Division 6 Section "General Carpentry" for dimension lumber items associated with wood decking.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.
- B. Samples: 24" long, showing the range of variation to be expected in appearance of wood decking.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Minimum 5 years' experience producing similar products.
- B. Certified Wood: decking certified as FSC Pure according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship.
- C. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable code at the location of the project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. General: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

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SECTION 061500 - WOOD DECKING

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- B. Grade Stamps: Provide solid wood decking with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, species, grade, moisture content at time of surfacing, and mill. Apply grade stamp to surfaces that will not be exposed to view.
- C. Moisture Content: Provide wood decking with 15 percent maximum moisture content at time of dressing.

2.2 SOLID WOOD DECKING

- A. Species: Select (WRC) Western Red Cedar
- B. Decking Nominal Size: 1 x 6 T&G
- C. Face Grade: Custom or Supreme: Clear face is required. Occasional pieces may contain a small knot or minor characteristic that does not detract from the overall appearance.
- D. Face Surface: Smooth.
- E. Edge Pattern: Vee grooved.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of decking and that adequate structural support has been provided. Starting work indicates installer's acceptance of existing conditions.

3.2 INSTALLATION

- A. Install wood decking to comply with manufacturer's written instructions.
 - 1. Install material plumb and true to line, cut and fitted.
 - 2. Scribe and cope as required for accurate fit to adjacent construction.
 - 3. Use manufactures recommended fasteners.
 - 4. Fasten tied to supports. Provide shims if there are variations in framing.

3.3 PROTECTION

- A. Protect from damage during construction operations. Promptly repair any damaged surfaces. Remove and replace work which cannot be satisfactorily repaired.

END OF SECTION 06 15 00

SECTION 06 16 00 - SHEATHING

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the sheathing.
- B. This Section includes the following:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Building paper.
 - 4. Building wrap.
 - 5. Sheathing joint-and-penetration treatment.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 06 Section "Millwork".
 - 3. Division 07 Section "Metal Roof Panels".
 - 4. Division 07 Section "Mineral Fiber Cement Board".
 - 5. Division 07 Section "Sheet Metal Flashing and Trim".
 - 6. Division 09 Section "Gypsum Board".

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 - 6. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

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B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Building wrap.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated in drawings.
- C. Factory mark panels to indicate compliance with applicable standard.
- D. Identify each panel with appropriate grade APA trademark and shall meet the requirements of the latest edition of US Product Standard PSI or one of the APA's performance standards.
- E. All plywood which has an edge or surface permanently exposed to the weather shall be classed Exterior.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Plywood in contact with earth, masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior, Exposure 1 and Interior sheathing, APA rated as indicated in drawings.
 - 1. Span Rating: Not less than 16/0.
 - 2. APA Rated sheathing EXP 1 or 2.
 - 3. Nominal Thickness: As indicated in drawings.

2.4 WALL AND CEILING PANELS

- A. APA rated A-C EXT
 - 1. "A" face exposed for painting or staining.
 - 2. Thickness: as indicated in drawings.
- B. Fiber Cement Board Sheathing: See Division 07 Section "Mineral Fiber Cement Board".

2.5 SOFFIT PANELS

- A. APA rated, exterior, southern yellow pine, plywood soffit panels
 - 1. Type: T1-11 with groove spacing 4-inch O.C. (Basis of Design: Plytanium plywood exterior panels as manufactured by Georgia-Pacific Wood Products).
 - 2. Thickness: As indicated in drawings.
 - 3. Finish: Rough Sawn for stain (as selected by architect from manufacture's full range of colors).
- B. Fiber Cement Board Sheathing: See Division 07 Section "Mineral Fiber Cement Board".

2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1 sheathing, APA rated
 - 1. Span Rating: Not less than 24/0.
 - 2. APA rated sheathing EXP 1 or 2 as indicated in drawings.
 - 3. Nominal Thickness: As indicated in drawings.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where roof sheathing is exposed to weather or in ground contact, of Type 304 stainless steel.
 - 2. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
 - 3. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

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- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329-inch thick, attach sheathing to comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112-inch thick, attach sheathing to comply with ASTM C 954.
- G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.8 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Paper: ASTM D 226, Type 2 (No. 30 asphalt-saturated organic felt), unperforated.
- B. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis of Design Products: DuPont (E. I. du Pont de Nemours and Company); weather barrier product; a weather-resistant membrane for vertical building envelope protection that will maintain air/moisture resistance while maintaining moisture-vapor permeability. The assembly consists of the following four components.
 - a. Weather barrier membrane (DuPont™ Tyvek® CommercialWrap®)
 - b. Seam Tape (DuPont™ Tyvek® Tape)
 - c. Flashing (DuPont™ FlexWrap™, DuPont™ StraightFlash™ and/or DuPont™ StraightFlash™)
 - d. StraightFlash™
 - e. Fasteners (DuPont™ Tyvek® Wrap Caps)
 - f. Or approved equal
 - 3. Water-Vapor Permeance: Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B. Allowable UV Exposure Time: Not less than three months.
- C. Building Wrap Tape: Pressure sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
- D. Roof Underlayment Material: As specified in Division 07 Section "Metal Roof Panels".

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Paper-Surfaced Gypsum Sheathing Board: Elastomeric, medium-modulus, neutralcuring silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealant."
- B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.
- C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Flashing (Self-Adhered Membrane Flashing): Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, crosslaminated polyethylene film to produce an overall thickness of not less than 30 mil.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor V40 Weather Barrier Strips.
 - c. MFM Building Products Corp.; Window Wrap.
 - d. Polyguard Products, Inc.; Polyguard 300.
 - e. Protecto Wrap Company; PS-45.
 - f. Or an approved equal.
 - 2. Application: General, not for roof, application. For roof application, see Separation Barrier as specified in Division 07 Section "Metal Roof Panels".
 - 3. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

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- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
 - 4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
 - 5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
 - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One and Two-Family Dwellings."
 - 8. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One and Two-Family Dwelling Code."
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall Sheathing:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8-inch apart at edges and ends.
 - 2. Roof Sheathing:
 - a. As indicated in Structural Drawings.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper as follows:
 - 1. Cut back barrier 1/2-inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

- B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.
- D. Roof Underlayment: As specified in Division 07 Section "Metal Roof Panels".

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
 - 3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 PROTECTION

- A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 00

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SECTION 06 17 53 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes wood roof, floor and girder trusses and truss accessories.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for roof sheathing and dimension lumber for supplementary framing and permanent bracing.
 - 2. Division 6 Section "Miscellaneous Carpentry" for roof sheathing and dimension lumber for supplementary framing and permanent bracing.

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NLGA - National Lumber Grades Authority.
 - 3. SPIB - Southern Pine Inspection Bureau.
 - 4. WCLIB - West Coast Lumber Inspection Bureau.
 - 5. WWPA - Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection under design loads: 1/240th of span

1.5 SUBMITTALS

- A. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material,

finish, design values, orientation, and location of metal connector plates required temporary and permanent truss member braces and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- C. Qualification Data: For metal-plate manufacturer, professional engineer, fabricator and installer.
- D. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.
 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer registered in the state that the project is constructed.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
 1. TP1 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.

- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

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. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. Mitek Industries, Inc.
 - 2. Metal Framing Anchors: Simpson Strong-Tie Company, Inc. No substitutes will be accepted.

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive natural or stained finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:

- B. Hot-Dip Galvanized Steel Sheet: ASTM A 653, G60 coating designation; Designation SS, Grade 33, and not less than 0.036 inch thick.
- C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, 80Z coating designation; ASTM A 570, Structural Steel (SS), Grade 33, and not less than 0.047 inch thick.
- D. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, AZ50 coating designation; Structural Steel (SS), Grade 33, and not less than 0.036 inch thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

2.5 METAL FRAMING ANCHORS

- A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
 - 1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/, G60 coating designation.
- C. Truss Tie-Downs (Hurricane or Seismic Ties): Simpson Strong-Tie connectors or anchors for fastening roof trusses supporting members as required by design.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not cut or remove truss members.
- K. Replace wood trusses that are damaged or do not meet requirements. Do not alter trusses in the field

3.2 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 061753

SECTION 06 18 50 - STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes framing using structural glued-laminated timbers.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber construction.

1.3 DEFINITIONS

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide structural glued-laminated timber, including connectors, capable of withstanding structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117--DESIGN or determined according to ASTM D 3737 and acceptable to authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For structural glued-laminated timber and connectors.
 - 1. Include data on lumber, adhesives, fabrication, and protection.
 - 2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treatment plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated materials.
 - 3. Include installation instructions for timber connectors.

- B. Shop Drawings: Show layout of structural glued-laminated timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.
 - 1. Include large-scale details of connections.
- C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber.
 - 1. Apply specified factory finish to three sides of half-length of each Sample.
- D. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.
- E. Qualification Data: For manufacturer.
- F. Research/Evaluation Reports: For structural glued-laminated timber

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC- or APA-licensed firm.
 - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA trademark. Place mark on surfaces that will not be exposed in the completed Work.
- B. Quality Standard: Comply with AITC A190.1, "Structural Glued Laminated Timber."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with provisions in AITC 111, "Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection."
- B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC 117--MANUFACTURING or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Provide structural glued-laminated timber made from a single species.
- B. Species and Grades for Structural Glued-Laminated Timber: Provide structural glued-laminated timber made from southern pine that complies with combination symbols and/or beam stress classifications indicated.

- C. Species and Grades for Beams: Provide structural glued-laminated timber that complies with AITC 117--MANUFACTURING or research/evaluation reports acceptable to authorities having jurisdiction and the following:
1. Species and Beam Stress Classification: Southern pine, 24F- V1 1.7E
 2. Lay-up: **Balanced**
- D. Appearance Grade: Architectural appearance grade, complying with AITC 110.
1. Use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.
- A. Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, pressure treat lumber before gluing according to AWPA C28.
1. Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.
 2. After dressing and fabricating members, apply a field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch (1.5 mm).
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
- B. Adhesive: Wet-use type complying with ASTM D 2559.
1. Use adhesive that contains no urea-formaldehyde resins.
- C. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- D. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.2 TIMBER CONNECTORS

- A. General: Unless otherwise indicated, fabricate from the following materials:
1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
- B. Fabricate beam hangers from steel with 3/16 inch stirrups and 1/4 inch top plates.
- C. Provide bolts, 1/2 inch, unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.
- D. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.3 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
 - 1. Dress exposed surfaces to remove plane or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- B. Camber: Fabricate horizontal members with spans greater than sixteen (16) feet with either circular or parabolic camber equal to 1/500 of span.
- C. End-Cut Sealing: Immediately after end-cutting each member to final length and after preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood-coated for not less than 10 minutes.
- D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for preservative-treated wood where treatment included a water repellent.

2.4 FACTORY FINISHING

- A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.
 - 1. Provide color selected by Architect from manufacturer's full range.
 - 2. Provide color matching Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of structural glued-laminated timber.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Erect structural glued-laminated timber true and plumb, with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - 1. Lift with padded slings and protect corners with wood blocking.
 - 2. Install structural glued-laminated timber to comply with Shop Drawings.
 - 3. Install timber connectors as indicated.

- B. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
 - 1. Predrill for fasteners using timber connectors as templates.
 - 2. Dress exposed surfaces to remove plane or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - 3. Coat crosscuts with end sealer.
 - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
 - 1. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

3.4 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.
 - 1. Coordinate wrapping removal with finishing work specified in Division 9. Retain wrapping where it can serve as a painting shield.

END OF SECTION 061850

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SECTION 071113 - BITUMINOUS DAMPPROOFING

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the bituminous dampproofing.
- B. This Section includes the following:
 - 1. Cavity side face of Concrete Unit Masonry (behind veneer).
 - 2. Exterior face of Concrete Unit Masonry walls which are the structural substrate below grade.
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Architectural Concrete Masonry".
 - 3. Division 07 Section "Water Repellents".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course. B. Material Certificates: For each product, signed by manufacturers.

1.4 JOB CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 BITUMINUS DAMPPROOFING

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sonneborn Brand Products; Hydrocide 600
 - b. Polyguard Product Inc.; Polyguard 500 NF non-fibrated emulsion dampproofing

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- c. Koppers Inc.; Liquid Asphalt 480 Dampproofing Emulsion
- d. Tamms Industries, Inc.; Dehydratine 75 Emulsified Asphalt Dampproofing Compounds.

C. Brush and Spray Coats: ASTM D 1227, Type III, class 1.

2.2 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 - 2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

3.4 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

3.5 PROTECTION

- A. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

END OF SECTION 07 11 13

SECTION 07 19 00 - WATER REPELLENTS

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. Scope: Provide all of the labor, materials, equipment and services required to apply the water repellents.
- B. This Section includes penetrating water-repellent coatings for the following vertical and horizontal surfaces:
 - 1. Concrete (unpainted).
 - 2. Cast stone.
 - 3. Concrete unit masonry (unpainted and unglazed).
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Architectural Concrete Masonry".
 - 3. Division 04 Section "Architecture Precast Concrete".
 - 4. Division 07 Section "Joint Sealant".
 - 5. Division 09 Section "Painting".

1.3 PERFORMANCE REQUIREMENTS

- A. Absorption: Minimum 80 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
 - 1. Stone: ASTM C 97.
 - 2. Concrete Unit Masonry: ASTM C 140.
 - 3. Hardened Concrete: ASTM C 642.
- B. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
- C. Permeability: Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, per ASTM D 1653.
- D. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
- E. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.
- F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
 - 1. Reduction of Water Absorption: 80 percent.
 - 2. Reduction in Chloride Content: 80 percent.

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1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard colors.
 - 3. Manufacturer's literature fully describing the product and the method of application for this project. The method and rate of application shall be completely outlined in order that the Architect will be fully aware of the procedure.
- B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.
- C. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.
- D. Preconstruction Testing Reports: For water-repellent-treated substrates.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.
- F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 548 for testing indicated.
- C. Application shall be made in the presence of an authorized representative of the manufacturer. The representative shall:
 - 1. Assure that the application and materials used are correct and will not violate the warranty.
 - 2. Ascertain that mil thickness of material(s) is in accordance with manufacturer's recommendations for this Project's specific conditions and that the warranty will not be violated.
 - 3. Submit a certified test report that the materials and thickness applied are correct to achieve water repellency and that a warranty can be issued.
- D. Warranty: Submit a written warranty, executed by the applicator and the manufacturer covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
 - 1. Warranty period: 5 years from Date of Substantial Completion.

1.6 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
1. Ambient temperature is above 40 deg F (4.4 deg C).
 2. Concrete surfaces and mortar have cured for more than 28 days.
 3. Concrete or brick masonry walls are not treated prior to 30 days after building close-in.
 4. Rain or snow is not predicted within 24 hours.
 5. Application proceeds more than 24 hours after surfaces have been wet.
 6. Substrate is not frozen, or surface temperature is above 40 deg F (4.4 deg C).
 7. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in Part 1 "Performance Requirements" Article within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Prediluted, Clear, silane and siloxane blends with 3.3 lb/gal. (400 g/L) or less of VOCs.
1. Products: Subject to compliance with requirements, provide one of the following products:
 - a. Tnemec Coating; Prime A Pell
 - b. BASF Building Systems: Hydrozo 100.
 - c. ProSoCo, Inc.; SL 100 Water Repeller or Weatherseal GP or Siloxane PD
 - d. Euclid Chemical Co.; Chemstop WB Heavy Duty

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to water-repellent manufacturer's written instructions, to ensure that surface is dry enough.
1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.
 2. Clay Brick Masonry: Clean clay brick masonry per ASTM D 5703.
- B. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

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- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Stir container just before using to assure the mixture of hydrophobic filler.
- C. Apply directly from the container using a good quality brush, roller, airless or conventional air type sprayer. Hudson garden type sprayers are allowed. Equip all sprayers with neoprene hose. All tools and equipment shall be clean prior to and during application to prevent possible staining or discoloring.
- D. Apply in a uniform manner that fully wets out the surface yet does not cause flooding or rundowns. "Pick off" any rundowns with a brush or dry roller to prevent unsightly lap or rundown marks.
- E. When spray applying, spray a uniform horizontal stroke followed by a uniform overlapping vertical stroke.
- F. Coverage rate: As recommended by the manufacturer.
- G. 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.
 - 1. Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.
- H. 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.

3.3 CLEANING

- A. 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.
- B. If applied to glass or anodized aluminum, remove immediately by wiping with a clean cloth saturated with Xylene or Reducer 990 followed with a mild detergent wash.

END OF SECTION 071900

SECTION 07 21 00 - THERMAL INSULATION

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the thermal insulation.
- B. This Section includes the following:
 - 1. Concealed building insulation/Foam-in-Place insulation.
 - 2. Glass-fiber blanket insulation.
 - 3. Masonry cell fill insulation.
 - 4. Sound attenuation insulation.
 - 5. Vapor retarders.
- C. Related Sections include the following:
 - 1. Division 04 Section "Architectural Concrete Masonry".
 - 2. Division 22 Section "Plumbing Insulation".
 - 3. Division 23 Section "Ductwork Insulation".

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.
- D. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.5 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

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1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 13-m/s air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 1. Surface-Burning Characteristics: ASTM E 84.
 - a. Flame spread factor: 15.
 - b. Fuel contributed factor: 0.
 - c. Smoke density factor: 75.
 - d. The above testing shall verify that, when these standard tests are extended to 30 min., there is no further flame progression.
 2. Fire-Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.
- B. Foam-in-place insulation: Independent testing and evaluations shall be provided to verify that the followings:
 1. Does not contain formaldehyde and is approximately 98% inorganic.
 2. Free from asbestos.
 3. Min. R-value required: 10.9
- C. Warranty: Manufacturer's standard warranty

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

2.2 FOAM-IN-PLACE INSULATION

- A. Product/manufacturer:
 - a. Core-Fill-500 as manufactured by Tailored Chemical Products, Inc.
 - b. PolyMaster R-501 CoreFoam by CFI Foam, Inc.
 - c. Thermco Foam Insulation by Thermal Corp. of America.
- B. Material: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.
 - 1. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
 - 2. Combustion Characteristics: Must be noncombustible, Class A building material.
 - 3. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.
 - 4. Insulation Values: For application on 8" CMU lightweight (not more than 105 lb density) must be R-9.1 min.
 - 5. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

2.3 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
 - a. CertainTeed Corporation.
 - b. Johns Manville.
 - c. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665.
 - 1. Type III (reflective faced), faced with foil-scrim-kraft/foil-scrim/foil-scrim-polyethylene polypropylene-scrim-kraft vapor-retarder membrane on 1 face;
 - 2. Class A (faced surface with a flame-spread index of 25 or less), for use in non-exposed applications only;

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3. Category 1 (membrane is a vapor barrier), vapor retarder to have permeance rating of 1 perm or less in compliance with ASTM E96 (tested with desiccant method using Procedure A). Install vapor retarder on warm-side-in-winter.

D. Thermal resistance: ASTM C 764

1. 12"- R38 attic application.
2. 3 ½" – R15 for wall application.
3. 6" – R19 for floor/ceiling application.
4. Refer to Division 13 Section "Pre-Engineered Metal Building System" for insulation in metal building system.

2.4 MASONRY-CELL FILL

- A. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Refer to Architectural drawings for required R-value of insulation.
- C. Refer to Division 04 Section "Architectural Concrete Masonry".

2.5 SOUND ATTENUATION INSULATION:

- A. General: Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- B. Basis of Design: USG sound attenuation blankets or approved equal.
- C. Non-combustible:
 1. Flame spread: 15
 2. Smoke spread: 0.
- D. Perimeter caulking: USG Acoustical Sealant.

2.6 VAPOR RETARDERS

- A. General: Provide with un-faced batt insulation that receives separate vapor retarders. Install vapor retarder on warm-side-in-winter.
- B. Polyethylene Vapor Retarders: ASTM D 4397, 0.15 mm thick, with maximum permeance rating of 0.13 perm.
- C. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 40 lbs/1000 sq. ft, with maximum permeance rating of 0.038 Grain / Hr•Ft² •in.Hg
 1. Products:
 - a. Raven Industries Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-65.

- D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- E. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- F. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
- G. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.7 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.8 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 - 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products:
 - a. Gemco; 90-Degree Insulation Hangers.
 - 2. Angle: Formed from 0.030 inch thick, perforated, galvanized carbon-steel sheet with each leg 2 inch square.
 - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

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- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1 1/2 inch square or in diameter.
 - 1. Products:
 - a. AGM Industries, Inc.; RC150.
 - b. AGM Industries, Inc.; SC150.
 - c. Gemco; Dome-Cap.
 - d. Gemco; R-150.
 - e. Gemco; S-150.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
 - b. Attic spaces.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.
 - 1. Products:
 - a. Gemco; Clutch Clip.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
 - 1. Products:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

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2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3 inch clearance of insulation around recessed lighting fixtures.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.6 INSTALLATION OF FOAMED-IN-PLACE INSULATION

- A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.
- B. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

3.7 INSTALLATION OF MASONRY-CELL FILL

- A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.8 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install 3 inch thick, un-faced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 4'-0" on either side of partition.

3.9 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16" o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.10 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

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SECTION 07 41 13 - METAL ROOF PANELS

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the prefabricated metal roofing.
- B. This Section includes Standing-Seam Metal Roof Panels.
- C. Related Sections include the following:
 - 1. Division 06 Section "Sheathing".
 - 2. Division 07 Section "Sheet Metal Flashing and Trim".
 - 3. Division 07 Section "Roof Accessories".

1.3 SUBMITTALS

- A. Prior to fabrication, submit to the Architect for review the following:
 - 1. Complete and fully descriptive manufacturer's literature which shall include, but not be limited to, naming all materials and components and the proper method of installation for this Project.
 - 2. Detailed Computer-generated drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work. Drawings shall indicate dimensions, all methods of securing. Detailed drawing shall be submitted to the Metal Panel Manufacturers for approval complying with specified warranty.
 - 3. Physical sample for color selection: All colors and textures available for the Architect.

1.4 PERFORMANCE REQUIREMENTS

- 1. Air Infiltration ASTM E-1680-95
- 2. Water Infiltration ASTM E-1646-95
- 3. Wind Uplift - U.L.90
- 4. Uplift Resistance for Roof Assembly – UL 580 (up to 120 mph wind speed).

1.5 QUALITY ASSURANCE

- A. Wind uplift: Provide roof panel system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.
- B. Field measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

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1.6 DELIVER, STORAGE AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.
- B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 WARRANTY

- A. Provide manufacturer's standard 20-years warranty stating the finish will be:
 - 1. Free of fading or color change in excess of 5 NBS units as measured per ASTM D2244;
 - 2. Will not chalk in excess of numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D659;
 - 3. Will not peel, crack, chip, or delaminate.
- B. Provide written warranty signed by applicator for 2-years period from Date of Substantial Completion of building covering repairs required to maintain roof and flashings in a watertight condition.
- C. Watertightness/weathertightness Warranty for concealed fastener panel system: Provide manufacturer's written 20-years warranty for watertightness test.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

2.2 METAL ROOF PANEL

- A. Product: The basis-of-design are "Cee-Lock" for non-structural panel and "Multi-rib R-Panel" for structural panel, both as manufactured by Berridge Manufacturing Co. Refer to drawings for specific application locations.
 - 1. Acceptable Manufacturers:
 - a. Berridge Manufacturing Co.
 - b. MBCI
 - c. Metal Sales Manufacturing Corporation.
 - d. Pac-Clad Petersen Aluminum.

2. Characteristics:
 - a. Cee-Lock: Standing seam panel, 1-1/2" high, 16-1/2" o.c. Snap-on seams shall contain an extruded vinyl weather seal insert as an integral part of the seam. Manufacturer's recommended roof slope of 1 on 12 or greater.
 - b. R-Panel: 36-inches coverage structural panel with or without striation. Capable to span up to 5-feet o.c. without solid sheathing. Manufacturer's recommended roof slope of 3 on 12 or greater.
 3. Material: Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Galvalume®) Steel Sheet, 24-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min.
 4. Finish: Kynar 500® fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil. Bottom side shall be coated with a primer and beige urethane coating with a total dry film thickness of 0.35 ± 0.05 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500® finish supplier
 5. Color: As selected by the Architect from Manufacturer standard/premium colors.
- B. Separation barrier: Provide materials approved by the Metal Roof Manufacturer.
1. High temperature Protection Self-adhering Roofing Underlayment to be installed on curved roof, low-slope roof and critical details as recommended by Metal Roof Manufacturer. Critical details included but not limited to valley, ridge and all flashing condition.
 - a. Carlisle WIP 300HT (40 mil).
 - b. Grace Ice and Water Shield (40 mil) or Grace Ultra (30 mil)
 - c. Tamko Tile and Metal Underlayment (75 mil) or Tamko TW Underlayment (40 mil)
 2. Sealant: Low-modulus Single Component Silicone: ASTM C 920, Type S, Grade NS, Class 100/50. Uses NT, M, G, A and O: single component, moisture curing, nonstaining, nonbleeding, color to match roof panel.
 - a. Tremco Spectrum One.
 - b. Dow 790.
 - c. Pecora 890-NST
- C. Accessories:
1. Flashings and accessories: Provided by the Metal Roof Manufacturer.
 - a. Provide all caps, trims, copings, fascias, corner units, flashings, closures and clips.
 - b. Provide manufacturer's standard ridge cap.
 - c. Fabricate of the same material as that of the roofing panel. Finish to match panel.

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SECTION 07 41 13 – METAL ROOF PANELS

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2. Gutters and downspouts:
 - a. Size and profiles as indicated on the Drawings.
 - b. Refer to Division 07 "Sheet Metal Flashing and Trim" for gutter and downspout.
 - c. Finish: As indicated in drawings.
3. Ridge vent: V600TE as manufactured by Cor-A-Vent or equivalent product approved by roof manufacturer.
4. Static Roof Vent: Model 750-GS as manufactured by Lomanco.
 - a. Size: 16-inches wide to fit between roof panel seams. Size to allow for not less than 40 sq.in. of net free area of ventilation.
 - b. Material: Galvanized Steel.
 - c. Finish: Prefinish to match roof panel color.

2.3 OTHER MATERIALS

- A. All other materials, not specifically described but required for a complete and proper installation that is secure, shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation shall be in accordance with the Contract Documents, the approved submittals and the manufacturer's instructions. Additionally conform to the standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.
- B. Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.
 1. Field cutting of panels by torch is not permitted.

3.2 PREPARATION

- A. Inspect the roof deck to verify that the deck is clean and smooth, free of depressions, waves or projections, level to $\pm 1/4"$ in 20', and properly sloped to valleys and eaves.
- B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- C. Verify deck is dry and free of snow or ice. Verify that deck joints are solidly supported.

3.3 INSTALLATION

- A. Install separation barriers prior to application of the metal roofing:
 - 1. At critical areas (gutters, ridge, valley, hip, rake) cover the deck with ice/water shield.
 - 2. Over the remaining roof deck, cover the entire deck area with a layer of felt. Overlap the felt onto the ice/water shield. Lap each ply 2" with the slope and nail with large flathead nails. Install felt horizontally, starting at eave to ridge with a 6" minimum overlap and 18" endlaps. Ensure that all nail heads are totally flush with the substrate. Nails shall be galvanized roofing nails with coated felt caps.
- B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.
- C. Install starter and edge trim before installing roof panels.
- D. Remove protective strippable film prior to installation of roof panels.
- E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved submittals.
- F. Install sealants for preformed roofing panels as approved on submittals.
- G. Do not allow panels or trim to come into contact with dissimilar materials.
- H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
- I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
- J. Remove and replace any panels or components which are damaged beyond successful repair.

3.4 CLEANING AND PROTECTION

- A. Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.
- C. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.
- D. Remove all scrap and construction debris from the site.

END OF SECTION 07 41 13

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SECTION 07 41 13 – METAL ROOF PANELS

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SECTION 07 46 00 - MINERAL FIBER CEMENT BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENT

- 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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the mineral fiber cement board siding, trim and soffit with moulding and accessories where shown on drawings or as specified herein.
- B. This Section includes the following:
 - 1. Fiber-cement vertical panel and trim for application over wall sheathing.
 - 2. Fiber-cement soffit panel for exterior application.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 06 Section "Sheathing".
 - 3. Division 07 Section "Thermal Insulation".
 - 4. Division 07 Section "Sheet Metal Flashing and Trim".
 - 5. Division 07 Section "Joint Sealant".
 - 6. Division 09 Section "Painting".

1.3 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate completion of mineral fiber cement board assemblies with interfacing and adjoining work for proper sequence of installation.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Installation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Manufacturer's best practice guide.
 - 4. Technical data sheet.
 - 5. Standard CAD drawings
- B. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cladding junctions and penetrations which are outside the scope of the standard details and specifications provided by the manufacturer.
- C. Research/Evaluation Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for non-asbestos fiber-cement products.
- D. Three 4 inches x 6 inches pieces of each type, color, texture, and pattern of siding, trim and soffit including related accessories, through one source from a single manufacturer.

LD# 19002 – BROOKHAVEN PARK IMPROVEMENTS

SECTION 07 46 00 – MINERAL FIBER CEMENT BOARD

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1.5 PERFORMANCE REQUIREMENTS

A. Fiber-Cement Siding:

1. Complies with ASTM C 1186 Type A Grade II as panel board, trim board, soffit and siding made from fiber-cement board that does not contain asbestos.
2. Complies with ASTM E 136 as a noncombustible material.
3. Complies with ASTM E 84 Class A
 - a. Flame Spread Index = 0 – 25
 - b. Smoke Developed Index = 0 - 450
4. Complies with ASTM E 119 1 hour and 2 hour fire resistive assemblies.
5. Tested to ASTM E330 for Transverse Loads.
6. To meet the following building code compliance National Evaluation Report NER405.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Panels and Trim shall be kept dry. Store it off the ground, lay flat on a smooth/level surface protected from dirt, moisture and direct sunlight, and covered with a waterproof cover that permits air circulation.
- B. Protect edges and corners from chipping.
- C. Follow any additional storage and product handling instructions as recommended by the manufacturer.

1.7 JOB CONDITION

- A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.
- B. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.
 - a. James Hardie Inc. (Basis-of-design).
 - b. CertainTeed Corporation.

c. Nichiha

2.2 PANEL BOARD

A. Product

1. HardiePanel® Vertical Siding
2. Texture: Smooth
3. Thickness: 5/16"
4. Size: Field cut, as indicated in drawings.
5. Weight: 2.3 lbs./sq.ft.
6. Finish: field painted, follow manufacturer recommendation.
7. Batten Strips: As indicated on drawings.

2.3 TRIM BOARD

A. Product

1. HardieTrim® Board
2. Texture: Smooth
3. Thickness: As indicated in drawings.
4. Size: As indicated in drawings.
5. Finish: Field painted, follow manufacturer recommendation.

2.4 ACCESSORIES

A. Trims: Trims in the following profiles supplied by Panel Manufacturer. Reveal Trims confirm to a 6063 alloy in T-5 temper with a minimum thickness of 0.050 inch. All reveal trims are 12 feet in length.

1. Horizontal trim.
2. Vertical trim.
3. Outside corner trim.
4. Inside corner trim.
5. Panel joint batten strips
6. J channel trim.
7. Drip cap trim.

B. Flashing: Provide aluminum flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating, same color as siding.

C. Caulking:

1. Elastomeric Joint Sealant: Comply with ASTM C920, Grade NS, Class 25 or higher
2. Latex Joint Sealant: Comply with ASTM C834
3. Caulking must be applied in accordance with the caulking/sealant manufacturer's written instructions or ASTM C1193

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SECTION 07 46 00 – MINERAL FIBER CEMENT BOARD

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2.5 FASTENERS

- A. Wood framing: 6d Galvanized siding nails (min. 0.093" shank x 0.222" head corrosion resistant siding nails). Must be of length to penetrate 1" into studs.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: For fastening requirements: comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind. Installation of scrap pieces is not acceptable. Provide full panel, cut to fit as required.
- B. Trim Board, Siding and Soffit
 1. Flashing: Install metal drip cap or flashing before applying trim and soffit. Provide drip cap "Z" flashing at all base/bottom and top trim board.
 2. Maintain clearance between trim and adjacent finish grade.
 3. Trim inside corner with single board.
 4. Install single board of outside corner board then align second corner board to outside edge of first corner board.
 5. Allow 1/8 inch gap between trim and siding.
 6. Provide batten strips at each panel joint. Seal gap with high quality, paintable caulk.
 7. Shim frieze board as required to align with corner trim.
 8. Install trim board over structural subfascia.
- C. Fasteners
 1. For Trim:
 - a. Fasten through trim into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
 - b. Fastener must penetrate minimum 3/4 inch or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
 - c. Position fasteners no closer than 3/4 inch and no further than 2 inches from side edge of trim board and no closer than 1 inch from end.
 - d. Fasten maximum 16 inch on center.
 - e. Do not fasten trim board on trim board.

2. For Siding:

- a. Fasten through siding into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
- b. Locate fasteners no closer than 3/8 inch from panel edges and no more than 2 inch from panel corners. At bottom edge, fasteners shall be placed no closer than 3/4 inch and no further than 1 inch from the plank bottom edge.
- c. Face fasteners to sheathing.

D. Joints

1. Butt joints shall occur only at solid backup. Adjacent pieces shall just lightly touch at butt joints; do not force or spring siding into place. Stagger butt joints so that there are at least two solid courses of siding separating butt joints occurring on the same stud.
2. Cover ALL non-perimeter butt joints with a painted 1x2 wood trim.
3. Cover ALL "inboard" perimeter edge joints with a painted 2x2 wood trim.
4. Cover ALL "outboard" perimeter edge joints with a painted 1x2 wood trim
5. Seal ALL gap with high quality, paintable caulk.

E. Finishing

1. Finish unprimed siding with minimum one coat high quality, alkali-resistant primer and one coat of either 100% acrylic or latex or oil based, exterior grade topcoat or two coats high quality, alkali-resistant, 100% acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
2. Finish sidings coated by the PrimePlus system with minimum one coat high quality, either 100% acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
3. Color: See division 09 "Painting" and "Exterior Finish Schedule" on Drawings.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 07 46 00

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SECTION 07 46 00 - MINERAL FIBER CEMENT BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENT

- 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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the mineral fiber cement board siding, trim and soffit with moulding and accessories where shown on drawings or as specified herein.
- B. This Section includes the following:
 - 1. Fiber-cement vertical panel and trim for application over wall sheathing.
 - 2. Fiber-cement soffit panel for exterior application.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 06 Section "Sheathing".
 - 3. Division 07 Section "Thermal Insulation".
 - 4. Division 07 Section "Sheet Metal Flashing and Trim".
 - 5. Division 07 Section "Joint Sealant".
 - 6. Division 09 Section "Painting".

1.3 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate completion of mineral fiber cement board assemblies with interfacing and adjoining work for proper sequence of installation.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Installation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Manufacturer's best practice guide.
 - 4. Technical data sheet.
 - 5. Standard CAD drawings
- B. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cladding junctions and penetrations which are outside the scope of the standard details and specifications provided by the manufacturer.
- C. Research/Evaluation Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for non-asbestos fiber-cement products.
- D. Three 4 inches x 6 inches pieces of each type, color, texture, and pattern of siding, trim and soffit including related accessories, through one source from a single manufacturer.

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SECTION 07 46 00 – MINERAL FIBER CEMENT BOARD

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1.5 PERFORMANCE REQUIREMENTS

A. Fiber-Cement Siding:

1. Complies with ASTM C 1186 Type A Grade II as panel board, trim board, soffit and siding made from fiber-cement board that does not contain asbestos.
2. Complies with ASTM E 136 as a noncombustible material.
3. Complies with ASTM E 84 Class A
 - a. Flame Spread Index = 0 – 25
 - b. Smoke Developed Index = 0 - 450
4. Complies with ASTM E 119 1 hour and 2 hour fire resistive assemblies.
5. Tested to ASTM E330 for Transverse Loads.
6. To meet the following building code compliance National Evaluation Report NER405.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Panels and Trim shall be kept dry. Store it off the ground, lay flat on a smooth/level surface protected from dirt, moisture and direct sunlight, and covered with a waterproof cover that permits air circulation.
- B. Protect edges and corners from chipping.
- C. Follow any additional storage and product handling instructions as recommended by the manufacturer.

1.7 JOB CONDITION

- A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.
- B. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.
 - a. James Hardie Inc. (Basis-of-design).
 - b. CertainTeed Corporation.

c. Nichiha

2.2 PANEL BOARD

A. Product

1. HardiePanel® Vertical Siding
2. Texture: Smooth
3. Thickness: 5/16"
4. Size: Field cut, as indicated in drawings.
5. Weight: 2.3 lbs./sq.ft.
6. Finish: field painted, follow manufacturer recommendation.
7. Batten Strips: As indicated on drawings.

2.3 TRIM BOARD

A. Product

1. HardieTrim® Board
2. Texture: Smooth
3. Thickness: As indicated in drawings.
4. Size: As indicated in drawings.
5. Finish: Field painted, follow manufacturer recommendation.

2.4 ACCESSORIES

A. Trims: Trims in the following profiles supplied by Panel Manufacturer. Reveal Trims confirm to a 6063 alloy in T-5 temper with a minimum thickness of 0.050 inch. All reveal trims are 12 feet in length.

1. Horizontal trim.
2. Vertical trim.
3. Outside corner trim.
4. Inside corner trim.
5. Panel joint batten strips
6. J channel trim.
7. Drip cap trim.

B. Flashing: Provide aluminum flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating, same color as siding.

C. Caulking:

1. Elastomeric Joint Sealant: Comply with ASTM C920, Grade NS, Class 25 or higher
2. Latex Joint Sealant: Comply with ASTM C834
3. Caulking must be applied in accordance with the caulking/sealant manufacturer's written instructions or ASTM C1193

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SECTION 07 46 00 – MINERAL FIBER CEMENT BOARD

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2.5 FASTENERS

- A. Wood framing: 6d Galvanized siding nails (min. 0.093" shank x 0.222" head corrosion resistant siding nails). Must be of length to penetrate 1" into studs.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: For fastening requirements: comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind. Installation of scrap pieces is not acceptable. Provide full panel, cut to fit as required.
- B. Trim Board, Siding and Soffit
 1. Flashing: Install metal drip cap or flashing before applying trim and soffit. Provide drip cap "Z" flashing at all base/bottom and top trim board.
 2. Maintain clearance between trim and adjacent finish grade.
 3. Trim inside corner with single board.
 4. Install single board of outside corner board then align second corner board to outside edge of first corner board.
 5. Allow 1/8 inch gap between trim and siding.
 6. Provide batten strips at each panel joint. Seal gap with high quality, paintable caulk.
 7. Shim frieze board as required to align with corner trim.
 8. Install trim board over structural subfascia.
- C. Fasteners
 1. For Trim:
 - a. Fasten through trim into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
 - b. Fastener must penetrate minimum 3/4 inch or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
 - c. Position fasteners no closer than 3/4 inch and no further than 2 inches from side edge of trim board and no closer than 1 inch from end.
 - d. Fasten maximum 16 inch on center.
 - e. Do not fasten trim board on trim board.

2. For Siding:

- a. Fasten through siding into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
- b. Locate fasteners no closer than 3/8 inch from panel edges and no more than 2 inch from panel corners. At bottom edge, fasteners shall be placed no closer than 3/4 inch and no further than 1 inch from the plank bottom edge.
- c. Face fasteners to sheathing.

D. Joints

1. Butt joints shall occur only at solid backup. Adjacent pieces shall just lightly touch at butt joints; do not force or spring siding into place. Stagger butt joints so that there are at least two solid courses of siding separating butt joints occurring on the same stud.
2. Cover ALL non-perimeter butt joints with a painted 1x2 wood trim.
3. Cover ALL "inboard" perimeter edge joints with a painted 2x2 wood trim.
4. Cover ALL "outboard" perimeter edge joints with a painted 1x2 wood trim
5. Seal ALL gap with high quality, paintable caulk.

E. Finishing

1. Finish unprimed siding with minimum one coat high quality, alkali-resistant primer and one coat of either 100% acrylic or latex or oil based, exterior grade topcoat or two coats high quality, alkali-resistant, 100% acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
2. Finish sidings coated by the PrimePlus system with minimum one coat high quality, either 100% acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
3. Color: See division 09 "Painting" and "Exterior Finish Schedule" on Drawings.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 07 46 00

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SECTION 07 46 00 – MINERAL FIBER CEMENT BOARD

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the sheet metal flashing and trim.
- B. This Section includes the following:
 - 1. Formed steep-slope roof flashing and trim.
 - 2. Formed wall flashing and trim.
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Architectural Concrete Masonry".
 - 3. Division 06 Section "General Carpentry".
 - 4. Division 07 Section "Mineral Fiber Cement Board".
 - 5. Division 07 Section "Metal Roof Panels".
 - 6. Division 07 Section "Roof Accessories".
 - 7. Division 07 Section "Joint Sealant".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.

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SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

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2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 1. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base on engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
 1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."
- B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical roof eave, including built-in gutter, fascia, fascia trim, apron flashing, at location as part of the completed work when approved, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
 3. 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.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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.

2.2 SHEET METALS

- A. Copper Sheet: ASTM B 370, H00 or H01 temper, cold-rolled copper sheet.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 1. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
 2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color: As selected by Architect from manufacturer's full range.
 3. Anodized Finish: Apply the following coil-anodized finish:

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- a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (Z275) coating designation; structural quality.
 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 3. Exposed Finishes: Apply the following coil coating:
 - a. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
 - b. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 1) Color: As selected by Architect from manufacturer's full range.
- D. Stainless-Steel Sheet: ASTM A 240, Type 304.
 1. Finish: No. 3 (reflective, polished directional satin)

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
 2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
 3. For Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

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1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. General: Refer to Division 07 for material provided by the Roof System Manufacturer. Provide prepainted Metallic-Coated Steel Sheet items not provided by the Roof System Manufacturer, includes but not limited to the followings:
 1. Apron, Step, Cricket, and Backer Flashing.
 2. Valley Flashing.
 3. Drip Edges.
 4. Eave, Rake, Ridge, and Hip Flashing.
 5. Base Flashing.
 6. Counterflashing.
 7. Flashing Receivers.
 8. Roof-Penetration Flashing.

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:
 1. Prepainted Metallic-Coated Steel Sheet.
- B. Openings Flashing in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:
 1. Prepainted Metallic-Coated Steel Sheet.
- C. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.[Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.

1. Copper: 10 oz. (0.34 mm thick) minimum for fully concealed flashing; 16 oz. (0.55 mm thick) elsewhere.
 - a. Available Products:
 - 1) Advanced Building Products Inc.; Cop-R-Loc Interlocking Flashing.
 - 2) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
 - 3) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
 - 4) Dur-O-Wal, Dayton Superior Corporation; Polytite Copper Flashing.
 - 5) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
 - 6) Sandell Manufacturing Company, Inc.; Three-Way Saw Tooth Flashing. 7) York Manufacturing, Inc.; Cop-R-Loc Interlocking Flashing.

2. Stainless Steel: 0.0156 inch (0.4 mm) thick.
 - a. Available Products:
 - 1) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
 - 2) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
 - 3) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.

- D. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.
 1. Available Manufacturers:
 - a. Cheney Flashing Company, Inc.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products Inc.
 - d. Hickman, W. P. Company.
 - e. Keystone Flashing Company, Inc.
 - f. Sandell Manufacturing Company, Inc.

 2. Material: Aluminum, 0.024 inch (0.6 mm) thick.
 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 7. Flexible Flashing Retainer Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.8 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, straps and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: A.
 - 2. Expansion Joints: Lap type.
 - 3. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following material:
 - a. Aluminum: 0.0320 inch (0.8 mm) thick.
 - 4. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following material:
 - a. Aluminum: 0.040 inch (1.0 mm) thick.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Manufactured Hanger Style: Standard.
 - 2. Fabricate downspouts from the following material:
 - a. Aluminum: 0.024 inch (0.6 mm) thick.

2.9 FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Aluminum: Use aluminum or stainless-steel fasteners.
 - 3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
 - 4. Stainless Steel: Use stainless-steel fasteners.

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- H. Seal joints with elastomeric sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealant."
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.
 - 1. Do not solder prepainted sheet.
 - 2. Pretinching is not required for zinc-tin alloy-coated stainless steel.
 - 3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 - 4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
 - 1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 04 Section "Architectural Concrete Masonry".
- C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete".
- D. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

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SECTION 07 72 00 - ROOF ACCESSORIES

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the roof accessories.
- B. This Section includes the following:
 - 1. Fabricated roof hatches.
 - 2. Attic Insulation Baffles.
 - 3. Roof Safety Platform.
 - 4. Roof Slip Guard.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 07 Section "Metal Roof Panels".
 - 3. Division 07 Section "Sheet Metal Flashing and Trim".

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- E. Closeout Submittals:
 - 1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
 - 2. Roof hatch manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

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1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.5 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis-of-design product.

2.2 ROOF HATCH

- A. Basis-of-Design: Type S Roof Hatch as manufactured by Bilco Company.
- B. Dimensions: 36 inches wide by 30 inches long. Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
- C. Performance characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or a maximum design pressure of + or - 70 psf (342kg/m²) with a factor of safety of 2.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.
- D. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
 - 1. Cover insulation: Shall be fiberglass of 1" (25.4mm) thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.

- E. Curb: Shall be 12" (305mm) in height and of 14 gauge paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
1. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25.4mm) thickness on outside of curb.
- F. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe for steel construction: through bolted to the curb assembly.
- G. Hardware:
1. Heavy pintle hinges shall be provided.
 2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
 3. Roof hatch shall be equipped with interior and exterior padlock hasps.
 4. The latch strike shall be a stamped component bolted to the curb assembly.
 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
 6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. Springs shall have an electro-coated acrylic finish for corrosion resistance.
 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- H. Finishes: Factory finish shall be alkyd based red oxide primed steel.

2.3 ATTIC INSULATION BAFFLE

- A. Basis-of-Design: Accuvent as manufactured by Berger, or an approved equal.
- B. Description:
1. Material: Non-porous, 100% recycled PVC.
 2. Size: 22 1/2" wide, to fit between roof truss.
 3. Air Flow: 25.3 sq.in.
- C. Application: To maintain continuous attic ventilation, install in pair with attic intake vent system (brick vent, soffit vent etc.) as indicated in drawings.

2.4 ROOF SAFETY PLATFORM

- A. Basis-of-Design: Metalwalk as manufactured by Design Components, Inc., or an approved equal. This is a metal grating walkway system including special attachments to metal Standing Seam Roof panels without penetrations.

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B. Description:

1. Material: 18-ga, AZ-50 Galvalume Steel, ASTM A792. Surface shall be Anti-Skid model.
2. Size: 12-inches wide.
3. Load: 3 lb. per lineal foot.
4. Accessories: Clips, clamps, bolts, nuts, washer etc as required as part of the product system. Provide in compatible material, non-corrosive type. For attachment to Standing Seam Metal roof panel, provide pre-finish S-5 clamp, select profile that is compatible with the roof panel profile.
5. Finish: Color to match roof panel color.

2.5 PREFORMED FLASHING SLEEVES

A. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Metal: Aluminum sheet, 0.063 inch thick.
2. Height: As indicated on Drawings
3. Diameter: As indicated on Drawings
4. Anodized Finish: Apply the following coil-anodized finish:
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

C. Seal joints with factory recommended sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 "Painting".
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

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 through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 07 Section "Fire-Resistive Joint Systems."
 - 2. Division 21 Sections specifying fire-suppression piping penetrations.
 - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
 - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.3 QUALITY ASSURANCE

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Applicator qualifications: Two years experience installing UL Classified fire stopping materials.
- C. Performance: Materials shall have been tested to provide fire rating equal to that of the construction.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Prior to installation, submit to the Architect for his review the following:

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1. Shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
 2. Copy of UL illustration of each proposed system indicating manufacturer approved modifications.
 3. Manufacturer's data: Specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
 4. Qualifications statement: Past projects indicating required experience.
- C. Qualification Data: For Installer.
- D. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Existing conditions:
1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
 2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- D. Environmental requirements:
1. Furnish adequate ventilation if using solvent.
 2. Furnish forced air ventilation during installation if required by manufacturer.
 3. Keep flammable materials away from sparks of flame.
 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by inspector, if required by authorities having jurisdiction.

1.8 WARRANTY

- A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the manufacturers approved by UL for the type of installation condition listed herein.
- B. Products:
 - 1. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated.
 - 2. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type

with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE INCLUDING, BUT NOT LIMITED, TO THE FOLLOWING:

- A. Metal pipe or conduit through round opening.
- B. Insulated metal pipe through round opening.
- C. Metal pipes or conduits through large opening.
- D. Busway through rectangular opening.
- E. Blank opening.

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- F. Non-metallic (plastic) pipe or conduit through opening.
- G. Metal pipe or conduit through gypsum board wall.
- H. Non-metallic (plastic) pipe or conduit through gypsum board wall.

END OF SECTION 07 84 13

SECTION 07 92 00 - JOINT SEALANT

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the sealant.
- B. The purpose of sealant in this Work is to provide a positive barrier against penetration of air and moisture at joints between items where sealant is essential to continued integrity of the barrier.
- C. This Section includes joint sealants for the following applications:
 - 1. General: Apply sealant at all exposed to view and exposed to weather gaps.
 - 2. Exterior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precaster architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in glass unit masonry assemblies.
 - e. Joints between siding and soffit panel.
 - f. Joints between trim board.
 - g. Joints between different materials listed above.
 - h. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - i. Control and expansion joints in, ceilings, and other overhead surfaces.
 - j. All joints that produce gap.
 - 3. Exterior joints in the following horizontal traffic surfaces:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. All joints that produce gap.
 - 4. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior wall openings, apply on both interior and exterior side.
 - c. Tile control and expansion joints.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows
 - e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - f. Fire-resistive joint system
 - g. All joints that produce gap.

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5. Interior joints in the following horizontal traffic surfaces:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.

D. Related Sections include the following:

1. Division 04 Section "Glass Unit Masonry".
2. Division 06 Section "Millwork".
3. Division 07 Section "Sheet Metal Flashing and Trim".
4. Division 08 Section "Hollow Metal Doors and Frames".
5. Division 08 Section "Aluminum Windows".
6. Division 09 Section "Painting".
7. Division 22 Section "Plumbing Fixtures".

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Complete and fully descriptive manufacturer's literature for each type of sealant used naming product formulation and giving product limitations.
2. Data proving the product meets or exceeds the Fed. Spec. referenced.
3. Physical sample of all colors for the Architect's selection.
4. Submit statements by the manufacturers and installers of their acceptance of these documents and conditions and/or any modification proposed to the use of the products. Include a statement from the manufacturer that the proposed use of the product for the conditions encountered is proper.
5. Submit warranty documents as stated under warranty of this section.

1.4 QUALITY ASSURANCE

A. Compatibility and adhesion testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under normal environmental conditions that will exist during actual installation.
2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required that are acceptable to Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

- B. Product testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations with in a 24 month period preceding date of Contractor's submittal of test results to Architect.
 - 1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.
- C. Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent required herein. His work shall have resulted in construction with a record of successful in-service performance and shall be able to show proof of successful similar projects completed over the past 7 years.
- D. Obtain joint sealant materials from a single manufacturer for each different product required.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 JOB CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions.
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than allowed by joint sealant manufacturer for application indicated.
 - 4. Until contaminants capable of interfering with their adhesion are removed from joint substrates.
- B. Note: Typical joint width shall be 3/8" unless otherwise advised by the joint manufacturer for the joint type involved or indicated differently on the Drawings.

1.7 WARRANTY

- A. Submit the following documents at the accountability of the manufacturer and installer:
 - 1. A guarantee warranting All defects of material and/or application for a period of five (5) years from Date of Substantial Completion. Any failure that may occur within this warranty period, due to defective application and/or materials shall, upon written notification of such failure, be repaired or replaced with proper materials and/or labor as approved by the Architect, at no additional cost to the Owner.

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PART 2 - PRODUCTS

2.1 SEALANT - EXPANSION JOINTS, CONTROL JOINTS, AND PERIMETER OF DOOR AND WINDOW FRAMES

A. Product/manufacturer:

1. Dynatrol II as manufactured by Pecora Corp.
2. Dymeric as manufactured by Tremco.
3. Sonloastic NP2 as manufactured by Sonneborn
4. Or approved alternate.

B. Type: Two-part, non-sag, low-modulus polyurethane rubber sealant.

1. FS TT-S-00227E, Class A, Type II.
2. ASTM C-920, Type M, Grade NS, Class 25, use NT, MA, A, G, and O.

C. Joint Backing: Closed-cell polyethylene.

D. Where joint depth does not permit use of joint backing, a release paper or bond breaker shall be used.

E. On horizontal joints, surface must be cleaned and primed using primer as recommended by the sealant manufacturer.

F. In all cases at aluminum storefront, curtain wall and windows, ensure and verify that specified sealant is compatible with aluminum finish.

1. If not, notify the Architect immediately in order that a new product may be selected.
2. Submit the aluminum storefront, curtain wall and window manufacturer's recommendation as to the type of product that should be substituted.

2.2 SEALANT - GENERAL PERIMETER SEALING AT TOILET FIXTURES, ACCESS DOORS, DOOR FRAMES, VANITIES, ETC. IN WET AREAS

A. Product/manufacturer:

1. 898 Sanitary Silicone Sealant as manufactured by Pecora Corp.
2. Tremsil 200 as manufactured by Tremco.
3. Or approved alternate.

B. Type: One-part, neutral-curing silicone.

1. FS TT-S-001543A.
2. FS TT-S-00230C, Class A.
3. ASTM C920, Class 25.

C. Install after completion of all painting.

2.3 SETTING THRESHOLDS; FLASHING; AND GENERAL SEALING NOT OTHERWISE DELEGATED

A. Product/manufacturer:

1. AC-20 + Silicone as manufactured by Pecora Corp.
2. Tremflex 834 as manufactured by Tremco.
3. Sonolastic Sonolac as manufactured by Sonneborn.
4. Or approved alternate.

B. Type: Siliconized one-part, non-sag, acrylic latex caulk.

1. ASTM C-834.

C. Joint Backing: Round closed-cell polyethylene.

2.4 FIRE-RESISTIVE JOINT SYSTEM

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG.

2.5 PRIMERS

A. As recommended by the sealant manufacturer for use in conjunction with the sealant for application onto the various types of materials to which the sealant applied, and complying with the requirements above. When the manufacturer's instructions make reference to use of primers and/or the construction condition requires special surface preparation, these instructions shall be complied with.

2.6 CLEANERS:

A. Where required by manufacturer's instructions in lieu of primers, shall be of the type and kind recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Surface cleaning of joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings, tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

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3. Remove laitance and form release agents from concrete and masonry.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other non-porous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Prime joint substrates where indicated and also where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 CHOICE OF CAULKING MATERIAL:

- A. Use only that caulking material which is best suited to the installation and is so recommended by the caulking material manufacturer.

3.3 BACK-UP MATERIALS:

- A. Verify the compatibility of filler material with caulking before installation.
- B. Use filler about 1/3 to 1/2 wider than width of joint so sufficient pressure is exerted by filler to provide substantial resistance to displacement.
- C. All filler materials shall be non-oily, non-staining, back-up filler such as polyethylene foam rod, expanded polyurethane, neoprene or other filler completely compatible with the caulking material.

3.4 APPLICATION OF CAULKING:

- A. Do not caulk under weather conditions or sun conditions potentially harmful to the set and curing of the caulking material.
- B. Deliver materials to the job or place of application in original unopened containers bearing manufacturer's name and product designation.
- C. Install caulking in strict accordance with the manufacturer's recommendations, taking care to produce beads of proper width and depth, to tool as recommended by the manufacturer, and to immediately remove all surplus caulking.

3.5 CAULKING SCHEDULE:

- A. Carefully study the Drawings and furnish and install the proper caulking at each point where called for on the Drawings plus at all other points, whether specifically designated or not, where caulking is essential in maintaining the continued integrity of the intended watertight barrier.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the hollow metal doors and frames.
- B. This Section includes the following:
 - 1. Hollow Metal Doors
 - 2. Hollow Metal Frames
- C. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealant".
 - 2. Division 08 Section "Door Hardware".
 - 3. Division 08 Section "Fixed Louvers and Grilles"
 - 4. Division 09 Section "Painting".

1.3 SUBMITTALS

- A. Prior to fabrication, submit to the Architect for review the following:
 - 1. Shop and erection drawings, including complete opening schedule with opening identification marks, details, elevations, dimensions, sections, gauges and hardware locations.

1.4 QUALITY ASSURANCE

- A. Comply with all pertinent codes and regulations.
- B. Manufacture all labeled hollow metal work in accordance with the requirements of Underwriter's Laboratories.
 - 1. Provide doors and frames with fire-resistance ratings indicated or required to comply with governing regulations.
 - 2. All labeled doors and frames shall be manufactured in accordance with the specifications procedures of the Underwriter's Laboratories. All labeled doors and frames shall physically bear the U.L. label showing the rating required.
 - a. The following are not acceptable:
 - 1) Stick-on type labels.
 - 2) Embossed frames.
 - 3) Labels not visible after frame installation.

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SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

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3. Agency under whom the testing was performed shall be the same for the door and the frame. Labels on the door and frame shall be the same and shall not indicate different testing agencies.
 4. For 1-1/2 hr. and 1 hr. doors used in stairway enclosures the average temperature developed on the unexposed side shall not exceed 450 deg F. at the end of 30 minutes of standard fire test exposure.
 5. UL 10C (positive pressure)/UBC7-2-97.
- C. U-value certification: All exterior doors and windows shall be labeled by the manufacturer to certify compliance with the requirements of fenestration rating council per NFRC 100-91:
1. Window U-value: .650 or less
 2. Door U-value: .650 or less.
- D. Warranty: Sample of special warranty.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 2. Warranty Period for Hollow Metal Doors: Life of installation.
 3. Warranty Period for Hollow Metal Frames: Life of installation.

PART 2 - PRODUCTS

2.1 DOORS

- A. Description:
 1. 1-3/4" thick, of composite construction, and fabricated of two sheets roller-leveled prime quality cold-rolled steel sheets.
 - a. Exterior:
 - 1) 14 gauge.
 - 2) SDI Level IV, Maximum-Duty Model 2A (seamless), A-60 galvanized.
 - b. Interior:
 - 1) 16 gauge.

- 2) SDI Level III, Extra Heavy-Duty Model 2A (seamless).
2. Provide rust-inhibitive primer, either air-drying or baking, suitable as base for specified finish paints.
3. Thermal/sound insulation: Interior of door shall be completely filled with rigid urethane core foamed in place and chemically bonded to all interior surfaces. Urethane shall be self-bonding, self-hardening, and self-extinguishing.
4. Doors shall have flush seamless face sheets with mechanically locked vertical edges. Exposed hairline seam on lock and hinge rail edge are acceptable.
5. Top and bottom of the doors shall be closed flush by 16 ga. steel channels.
6. Hardware preparation:
 - a. Hinge reinforcements shall be 7 ga. Steel drilled and tapped by the manufacturer.
 - b. Doors shall be mortised for template hinges and prepared for locksets.
7. Doors prepared for lights shall have the openings framed and securely attached. Glazing beads shall be screwless snap-in type.
8. Louvers: See Division 08 Section "Fixed Louvers and Grilles" for security louver and grille insert on non-rated door panel.

2.2 FRAMES:

A. Welded unit frames:

1. Exterior:
 - a. 14 ga., SDI Level IV, commercial quality, cold-rolled steel.
 - b. A-60 galvanized.
2. Interior:
 - a. 16 ga., SDI Level III, commercial quality, cold-rolled steel.

B. Description:

1. Head and jamb members shall be mitered, securely welded and ground smooth.
2. Provide rust-inhibitive primer, either air-drying or baking, suitable as base for specified finish paints.
3. Provide 5/8" high integral stops and 2" faces normally available from stock.
4. Provide with appropriate jamb anchors and with floor anchors which are adjustable.
5. Double swing doors: Provide two rubber silencers for strike jambs and heads.

C. Hardware preparation:

1. Minimum gauges for hardware reinforcements:
 - a. Hinge reinforcements: 7 gauge.
 - b. Universal strike reinforcements: 12 gauge.
2. Hinge jambs shall be mortised for template hinges and lock jambs shall be mortised for ANSI A115.1 and .2 universal lock strike.
3. Plaster guards shall be snap-in type.
4. Hinge and strike reinforcements shall be drilled and tapped by the manufacturer.

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5. Coordinate and prepare any frames that require electric strikes as required to accept electric strikes – refer to drawings and specifications for additional information.

2.3 LABELED DOORS AND FRAMES:

- A. Provide labeled doors and frames for those openings requiring fire protection ratings.
 1. Construct and test in accordance with the standards of Underwriter's Laboratories (UL).
 2. The UL physical label shall be affixed to all labeled units as evidence of compliance with the procedures of the labeling agency.
 3. Advise the Architect prior to fabricating if any door or frame that is required to be fire-rated cannot qualify for appropriate labeling because of its design, hardware or for any other reason.

2.4 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.8 mm thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 16 mm high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.8 mm thick, fabricated from same material as frames in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install all hollow metal in strict accordance with all pertinent codes and regulations, the approved submittals, the Contract Documents, and the manufacturer's current recommendations, anchoring all components firmly in position for long life under hard use.
- B. Prior to installation, all frames must be checked and corrected for rack, twist, and out-of-square.
- C. Erect frames plumb and true, firmly bracing in position until masonry work has reached full height of frames. Do not remove channel spreaders until frames are securely anchored in place.
- D. Erect frames and masonry openings to prevent contact between frames and masonry mortar.
- E. Leave all installed material clean, free of all foreign matter, or rust spots ready to receive finish painting. See Division 09 Section "Painting".
- F. Install all finish hardware in strict accordance with the manufacturer's recommendations, eliminating all hinge-bound conditions and making all items smoothly operating and firmly anchored into position

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the door hardware.
- B. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- C. This Section includes the following:
 - 1. Lock cylinders and keys
 - 2. Lock and latch sets
 - 3. Bolts
 - 4. Key control system
 - 5. Silencers
 - 6. Weather-stripping for exterior doors
 - 7. Sound stripping for interior doors
 - 8. Smoke Seals
 - 9. Automatic drop seals (door bottoms)
 - 10. Door Sweeps / Door Shoes for exterior doors
 - 11. Thresholds
 - 12. Stops – Floor, Wall, and Kick
 - 13. Hinges – Standard, Continuous and Spring
 - 14. Spring hinges
 - 15. Pivots
 - 16. Closers
 - 17. Overhead holders
 - 18. Exit devices
 - 19. Push/Pull units
 - 20. Door trim units
 - 21. Protection plates
 - 22. Latch Guards
 - 23. Electric Strikes
 - 24. Astragals or meeting seals on pairs of doors
 - 25. Miscellaneous door control devices
- D. Related Sections include the following:
 - 1. Division 08 Section “Hollow Metal Doors and Frames”.
 - 2. Division 08 Section “Access Doors and Frames”.
 - 3. Division 08 Section “Overhead Coiling Doors”.
 - 4. Division 26 Section “Electrical” – Various Sections

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- E. Products furnished but not installed under this Section to include:
 - 1. Cylinders for locks on entrance doors.
 - 2. Final replacement cores and keys to be installed by Owner.

1.3 REFERENCES

- A. Standards of the following as referenced:
 - 1. American National Standards Institute (ANSI)
 - 2. Door and Hardware Institute (DHI)
 - 3. American Society of Hardware Consultants (ASHC)
 - 4. Builders Hardware Manufacturers Association (BHMA)
 - 5. Federal Specifications (FS)
 - 6. National Builders Hardware Association (NBHA)
 - 7. Factory Mutual (FM)
 - 8. National Fire Protection Association (NFPA)
 - 9. Underwriters' Laboratories, Inc. (UL)
 - 10. UL 10C - Fire Tests Door Assemblies
 - 11. Warnock Hersey
- B. Regulatory standards of the following as referenced:
 - 1. Department of Justice, Office of the Attorney General, *Americans with Disabilities Act*, Public Law 101-336 (ADA).
 - 2. CABO/ANSI A117.1: *Providing Accessibility and Usability for Physically Handicapped People*, 1992 edition.

1.4 SYSTEM DESCRIPTION

- A. Refer to applicable "Headings" for system description for electric and electro-pneumatic hardware products.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
- B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements. For items other than those scheduled in the "Headings" of Section 3, provide catalog information for the specified items and for those submitted.
- C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.

- g. Door and frame sizes and materials.
 - h. Keying information.
 - i. Cross-reference numbers used within schedule deviating from those specified.
 - 1) Column 1: State specified item and manufacturer.
 - 2) Column 2: State prior approved substituted item and its manufacturer.
2. Furnish complete wiring diagrams, riser diagrams, elevation drawings and operational descriptions of electrical components and systems, listed by opening in the hardware submittals. Elevation drawings shall identify locations of the system components with respect to their placement in the door opening. Operational descriptions shall fully detail how each electrical component will function within the opening, including all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval. Supply a copy with delivery of hardware to the jobsite and another copy to the Owner at the time of project completion.
3. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
- D. Provide Samples (if requested) of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
- 1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the Work, within limitations of keying coordination requirements.
- E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- F. Contract closeout submittals:
- 1. Operation and maintenance data: Complete information for installed door hardware.
 - 2. Warranty: Completed and executed warranty forms.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced Architectural Hardware Consultant (AHC) who is available for consultation to Owner, Architect, and Contractor, at reasonable times during the course of the Work.

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- C. Coordination Meetings:
 - 1. Contractor shall set up and attend the following:
 - a. Lock distributor to meet with the Owner to finalize lock functions and keying requirements and to obtain final instructions in writing.
 - b. Lock distributor and lock, closer and exit device manufacturer to meet with the installer prior to beginning of installation of door hardware. Instruct installer on proper installation of specified products.
 - 2. General Contractor shall set up and attend the following:
 - a. Meet with the Owner, General Contractor, Supplier, electrical and security contractors to coordinate all electrical hardware items. Supplier to provide riser diagrams, elevation drawings, wiring diagrams and operational descriptions as required by the General and sub-contractors.
- D. Fire-Rated Openings:
 - 1. Provide door hardware for fire-rated openings in compliance with NFPA Standard No. 80 requirements of authorities having jurisdiction.
 - 2. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
 - 3. All hardware shall comply with State and local codes and UL 10C. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. All hardware is to comply with Federal and State Handicap laws. Provide tactile warning at the back of all outside levers to electrical, mechanical, machine rooms and doors that lead to hazardous areas.
- F. All hardware shall be provided in accordance with the requirements of the Americans with Disabilities Act (ADA) and American National Standards Institute, Inc (ANSI).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.8 WARRANTY

- A. Special warranties:
 - 1. Door Closers: Ten year period
 - 2. Exit Devices: Three year period
 - 3. Automatic Door Operators: Two year period
 - 4. Locks and Cylinders: Three year period

1.9 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS (*Denotes manufacturer referenced in the Hardware Headings)

- A. Hinges:
 - 1. Acceptable manufacturers:
 - a. McKinney*
 - b. Ives
 - c. Bommer
 - 2. Characteristics:
 - a. Templates: Provide only template-produced units.
 - b. Screws: Provide Phillips flat-head screws complying with the following requirements:
 - 1) For metal doors and frames install machine screws into drilled and tapped holes.
 - 2) For wood doors and frames install threaded-to-the-head wood screws.
 - 3) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
 - 4) Finish screw heads to match surface of hinges or pivots.
 - c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1) Out-Swing Exterior Doors: Non-removable pins.
 - 2) Out-Swing Corridor Doors with Locks: Non-removable pins.
 - 3) Interior Doors: Non-rising pins.
 - 4) Tips: Flat button and matching plug. Finished to match leafs.
 - d. Size: Size hinges in accordance with specified manufacturer's published recommendations.
 - e. Quantity: Furnish one pair of hinges for all doors up to 5'-0" high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.
- B. Continuous Hinges:
 - 1. Acceptable manufacturers:
 - a. Pemko*
 - b. Ives
 - c. Select Products
 - d. Markar

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2. Characteristics:
 - a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish as scheduled.
 - b. All hinges are to be manufactured to template. Uncut hinges shall be non-handed and shall be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
 - c. Vertical door loads shall be carried on chemically lubricated polyacetal thrust bearings. The door and frame leaves shall be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180°.
 - d. Hinges to be milled, anodized and assembled in matching pairs.
 - e. Fasteners supplied shall be 410 stainless steel, plated and hardened.
 - f. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors (suffix -FR) shall meet the required ratings without the use of auxiliary fused pins or studs.

- C. Cylinders:
 1. Acceptable manufacturers:
 - a. Schlage* Everest 29 / Everest D. (Confirm meets Owner's standard)
 2. Characteristics:
 - a. Equip locksets with interchangeable core cylinders featuring patented, restricted keys (Schlage Everest 29) and auxiliary locking pin. Patented key and cylinder design shall be valid until 2029.
 - b. Permanently inscribe each key and with number of lock that identifies cylinder, manufacturer's key symbol, and notation, "DO NOT DUPLICATE". Also stamp each core with manufacturer's key symbol.
 - c. Final cores and keys will be furnished and installed by the owner.
 - d. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
 - e. Key Material: Provide keys of nickel silver only.
 - f. Provide 10 construction master keys and 2 construction control keys.
 - g. Provide copies of each to the owner. Coordinate with GC and owner.
 - h. Keying to include an import file for Site Master.

- D. Locksets, Latchsets, Deadbolts:
 1. Acceptable manufacturers:
 - a. Schlage* (Confirm meets Owner's standard)
 2. Mortise Locksets and Latchsets: as scheduled.
 - a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.
 - b. Latchbolts: 3/4-inch throw stainless steel anti-friction type.
 - c. Lever Trim: Through-bolted, accessible design, cast or solid rod lever as scheduled. Spindles: Independent break-away.
 - d. Thumbturns: Accessible design not requiring pinching or twisting motions to operate.
 - e. Deadbolts: Stainless steel 1-inch throw.
 - f. Electric operation: Manufacturer-installed continuous duty solenoid.
 - g. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
 - h. Scheduled Lock Series and Design:
 - i. Schlage ND Series, Grade 1 06 - Rhodes (RHO) Lever

- j. Certifications:
 - 1) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
 - 2) ANSI/ASTM F476-84 Grade 30 UL Listed.
- 3. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled, fastened with through-bolts.
 - a. Chassis: Cylindrical design, corrosion-resistant plated cold-rolled steel.
 - b. Locking Spindle: Stainless steel, interlocking design.
 - c. Latch Retractors: Forged steel. Balance of inner parts: Corrosionresistant plated steel, or stainless steel.
 - d. Lever Trim: Accessible design, independent operation, spring-cage supported, minimum 2" clearance from lever mid-point to door face.
 - e. All lock functions: 7 year warranty, Vandalguard function outside lever is disengaged when in the locked mode.
 - f. Rosettes: Minimum 3-7/16" diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.
 - g. Springs: Full compression type.
 - h. Electric operation: Manufacturer-installed continuous duty solenoid.
 - i. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
 - j. Lock Series and Design: Schlage ND series, RHODES design.
 - k. Certifications:
 - 1) ANSI A156.2, 1994, Series 4000, Grade 1. Tested to exceed 3,000,000 cycles.
 - 2) UL listed for A label single doors up to 4 ft x 8 ft.
- E. Exit Devices:
 - 1. Acceptable manufacturers:
 - a. Von Duprin* (Owners standard)
 - 2. Characteristics:
 - a. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."
 - b. All exit devices mounted on labeled wood doors shall be mounted on the door per the door manufacturer's requirements.
 - c. All trim to be thru-bolted to the lock stile case, and SNB at the hinge side. Lever design to match locksets (07A).
 - d. Attach all exit devices with sex nuts and bolts.
 - e. All exit devices shall be made of brass, bronze, stainless steel, or aluminum material, powder coated, anodized, or plated to the standard architectural finishes to match the balance of the door hardware.
 - f. Provide glass bead conversion kits to shim exit devices on doors with raised glass beads.
 - g. All exit devices shall be one manufacturer. No deviation will be considered.
 - h. All series exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. All exit devices shall be nonhanded. Touchpad shall extend a minimum of 1/2 of the door width and shall extend to the height of the cross rail housing for a "no pinch" operation. Plastic touchpads are not acceptable. All latchbolts to be the deadlocking type. Latchbolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable. Plastic linkage and "dogging" components are not acceptable.

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- i. Lever trim shall be solid case material with a break-away feature to limit damage to the unit from vandalism.
- j. Surface vertical rod devices shall be UL labeled for fire door applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.
- k. Exit devices to include impact resistant, flush mounted end cap design to avoid damage due to carts and other heavy objects passing through an opening. End cap shall be of heavy-duty metal alloy construction and provide horizontal adjustment to provide alignment with device cover plate. When exit device end cap is installed, no raised edges will protrude.

F. Electric Strikes:

1. Acceptable manufacturers:

- a. Von Duprin* - 6100 Series

Confirm strike provides owner required functions and control and meets current and future design standards requested by owner. Owner intends to activate strike to lock and secure building from remote location.

2. Characteristics:

- a. Heavy duty, stainless steel construction.
- b. Adjustable strike box to compensate for any misalignment of door or frame.
- c. Two-piece plug connectors for ease of installation and for removal during strike servicing.

G. Electromagnetic Locks:

1. Acceptable manufacturers:

- a. Schlage*- M400 Series

Confirm electromagnetic lock provides owner required functions and control and meets current and future design standards requested by owner. Owner intends to lock and secure building during set times with a timer.

2. Characteristics:

- a. Heavy duty, 1,500 pound holding force.
- b. Armature mount pivot feature compensates for slight opening imperfections for a better bond.
- c. Symmetrical design speeds in-field handling.

H. Closers and Door Control Devices:

1. Acceptable manufacturers:

- a. LCN Closers* - 4040XP Series

2. Characteristics:

- a. Attach all closers with thru-bolts (no exceptions).
- b. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
- c. All closers shall utilize a stable fluid withstanding temperature range of 120°F to -30°F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UBC 7-2 (1997) and UL 10C.

- d. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Spring power adjustment (LCN Fast™ Power Adjust) allows for quick and accurate power adjustment and visually shows closer power size settings by way of dial adjustment gauge located on closer spring tube. Hydraulic regulation shall be by tamper-proof, noncritical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
 - e. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a cast-in solid stop on the closer shoe (“CUSH”). All parallel arm mounted closers shall have “EDA” type arms or, where door travel on out-swing doors must be limited, use “CUSH” or “SCUSH” type closers. Auxiliary stops are not required when “CUSH” type closers are used.
 - f. All surface closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory. All closers (overhead, surface and concealed) shall be of one manufacturer and carry manufacturer's ten year warranty (electric closers to have two year warranty).
 - g. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.
 - h. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.
 - i. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.
 - j. Magnetic Door Holders to be heavy duty wall or floor mounted with metal housing and complete mounting hardware. Provide 24V holding coils unless otherwise scheduled.
- I. Overhead Door Holders:
- 1. Acceptable manufacturers:
 - a. Glynn Johnson*
 - b. Rixson Firemark
 - c. Rockwood
 - 2. Characteristics:
 - a. Provide (heavy duty and/or medium duty and/or light duty) door holders (concealed and/or surface mounted) of brass, bronze or stainless steel.
 - b. Concealed holders to be installed with the jamb bracket mortised flush with the bottom of the jamb. The arm and channel to be mortised into the door.
 - c. Surface holders to be installed with the jamb bracket mounted on the stop.
- J. Floor Stops and Wall Bumpers:
- 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*
 - b. Trimco
 - c. Ives
 - 2. Characteristics: Refer to Hardware Headings.
- K. Door Bolts/Coordinators:
- 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*

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- b. Trimco
- c. Ives
- 2. Characteristics:
 - a. Flush bolts to be forged brass 6-3/4" x 1", with 1/2" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.
 - b. Automatic flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
 - c. Self-latching flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
 - d. Automatic flush bolts and self-latching flush bolts shall be UL listed for fire door application without bottom bolts (LBB).
 - e. Furnish dust proof bottom strikes.
 - f. Coordinator to be soffit mounted non-handed fully automatic UL listed coordinating device for sequential closing of paired doors with or without astragals.
 - g. Provide filler pieced to close the header. Provide brackets as required for mounting of soffit applied hardware.
- L. Push Plates:
 - 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*
 - b. Trimco
 - c. Ives
 - 2. Characteristics:
 - a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.
 - b. Material to be wrought/extruded/forged, brass/ bronze
 - c. /aluminum/stainless steel, per the Hardware Headings.
 - d. Provide plates sized as shown in Hardware Headings.
- M. Door Pulls & Pull Plates:
 - 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*
 - b. Trimco
 - c. Ives
 - 2. Characteristics:
 - a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.
 - b. Material to be extruded forged/ cast, brass/ bronze/ aluminum/ stainless steel.
 - c. Provide units sized as shown in Hardware Headings.
- N. Push Pull Sets:
 - 1. Acceptable manufacturers:
 - a. Ives*
 - b. Trimco
 - c. Rockwood Manufacturing
 - 2. Characteristics:
 - a. Provide mounting systems as shown in hardware sets.

- b. Material to be (description - i.e. solid rod, tubular, cast etc.). Brass/bronze aluminum/stainless steel.
 - c. Provide Push/Pull sets sized as shown in Hardware Headings.
- O. Protective Plates:
- 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*
 - b. Trimco
 - c. Ives
 - 2. Characteristics:
 - a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
 - b. Materials:
 - 1) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage). Fabricate protection plates not more than 2 inches less than door width on push side and not more than 1 inch less than door width on pull side.
 - c. Heights:
 - 1) Kick plates to be 8 inches in height.
 - 2) Mop plates to be 4 inches in height.
 - 3) Armor plates to be 36 inches in height.
 - a) Armor plates on fire doors to comply with NFPA 80.
- P. Latch Guard:
- 1. Acceptable manufacturers:
 - a. Rockwood Manufacturing*
 - b. Trimco
 - c. Ives
 - 2. Characteristics:
 - a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
 - b. Materials:
 - 1) Metal Plates: Stainless Steel, .100 inch .
 - c. Heights:
 - 1) 1-5/8" x 6" – verify size to secure all latches on door
- Q. Thresholds:
- 1. Acceptable manufacturers:
 - a. Pemko*
 - b. National Guard Products, Inc.
 - c. Reese Enterprises
 - d. Zero International, Inc.
 - 2. Types: Indicated in Hardware Headings.
- R. Door Seals/Gasketing:
- 1. Acceptable manufacturers:

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- a. Pemko*
 - b. National Guard Products, Inc.
 - c. Reese Enterprises
 - d. Zero International, Inc.
 - 2. Types: Indicated in Hardware Headings.
- S. Door Sweeps/Shoes
- 1. Acceptable manufacturers:
 - a. Pemko*
 - b. National Guard Products, Inc.
 - c. Reese Enterprises
 - d. Zero International, Inc.
 - 2. Types: Indicated in Hardware Headings
- T. Silencers:
- 1. Acceptable manufacturers:
 - a. Hager*
 - b. Ives
 - c. Rockwood Manufacturing
 - 2. Three for each single door; two for each pair of doors.
- U. Key Cabinet and System:
- 1. Acceptable manufacturers:
 - a. Telkee, Inc.
 - 2. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the project.
 - a. Provide complete cross index system set up by key control distributor, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.
 - c. Provide multiple-drawer type cabinet.
- V. Security Equipment:
- 1. Acceptable manufacturers:
 - a. Schlage Electronics: Schlage AD200-70-MTK-ATH-PD
 - b. Provide Software SMS Premier "SPRE-SFT-1"
 - c. Provide one hand held programmer "HHD Kit".
 - 2. Characteristics: Provide items as found in Hardware Headings.
 - 3. Coordinate security equipment with electrical.

2.2 MATERIALS AND FABRICATION

- A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
 - 1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
 - 2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Use thru-bolts for installation of all exit devices, closers, and overhead stops. Coordinate with wood doors and metal doors and frames where thru-bolts are used, as a means of reinforcing the work, provide sleeves for each thru-bolt.

2.3 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
- B. Provide finishes that match those established by ANSI or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."
- E. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
 - 1. Hinges (Exterior): 630 (US32D) Satin Stainless Steel
 - 2. Hinges (Interior wood doors): 652 (US26D) Satin Chrome Plated Steel
 - 3. Continuous Hinges: 628 (US28) Clear Anodized Aluminum
 - 4. Flush Bolts: 626 (US26D) Satin Chrome Plated Brass/Bronze
 - 5. Locks: 626 (US26D) Satin Chrome Plated Brass/Bronze

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6. Exit Devices:	628 (US28) - chassis, 689 (PC) Powder Coated - covers, 630 (US32D) - touchpads
7. Strikes:	626 (US26D) Satin Chrome Plated Brass/Bronze
8. Electric Strike:	630 (US32D) Satin Stainless Steel
9. Electromagnetic Lock:	628 (US28) – Aluminum housing
10. Deadbolts:	626 (US26D) Satin Chrome Plated Brass/Bronze
11. Door Closers:	689 (PC) Powder Coated Aluminum
12. Push Plates:	630 (US32D) Satin Stainless Steel
13. Pull Plates/Trim:	630 (US32D) Satin Stainless Steel
14. Protective Plates:	630 (US32D) Satin Stainless Steel
15. Door Stops:	630 (US32D) Satin Stainless Steel
16. Overhead Holders:	630 (US32D) Satin Stainless Steel 689 (PC) Powder Coated Steel (as scheduled)
17. Thresholds/Weatherstripping:	627/628 (US27/US28) Aluminum
18. Latch Guard:	630 (US32D) Satin Stainless Steel
19. Silencers:	Vinyl Grey

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - 2. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute.
 - 3. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealant".
- E. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Door Hardware Supplier's Field Service:
1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.
 2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
 3. File written report of this inspection to Architect.
- D. Door Hardware Manufacturer's Field Service:
1. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturers shall inspect and certify that all units are installed in accordance with the manufacturer's instructions, and are regulated properly and functioning correctly.
 2. A written report of the inspection results and recommendations shall be provided to the Architect and shall include the appropriate certificates.

3.3 DOOR HARDWARE NOTES

- A. Verify all lock and key sets with owner prior to submittal.
- B. Provide Hardware per leaf for all double doors unless noted otherwise.
- C. Deadbolts at restroom locations should not be lockable by thumb turn from interior side. Thumb turn at interior side is for unlock only. Deadbolt is locked from the exterior side by key.

3.4 DOOR FUNCTION DESCRIPTIONS

- A. PASSAGE LATCH
1. Latchbolt released by turning inside lever or outside lever.
 2. No locking functions
- B. PASSAGE EXIT
1. Exit Device on Inside
 - a. Dummy pull trim on the outside
- C. PASSAGE SECURITY (WITH DEADBOLT)
1. Exit Device on Inside
 - a. Dummy pull trim on the outside
 2. Deadbolt with interchangeable keyed cylinder on the outside
 - a. Dummy deadbolt trim on the inside.
 - b. Key extends and retracts deadbolt.
 - c. No interior function.

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D. DORMITORY

1. Throw-off latchbolt by either lever except when pushbutton or key locks outside lever.
2. Pushbutton released by turning inside lever, outside key or by closing door.
3. Depressed pushbutton indicates door is locked.
4. When outside lever is locked by key, it can be unlocked by key or by turning inside lever to release pushbutton.
5. Inside lever is always free for immediate egress.
6. Outside lever is rigid when locked.

E. CLASSROOM

1. Latchbolt released by turning inside lever or outside lever.
 - a. Exception: Cannot release from outside if locked by key.
2. Inside lever is always free for immediate egress.
3. No push lock on inside.
4. Outside lever is rigid when locked.

F. CLASSROOM SECURITY

1. Key lock on inside and outside
2. Latchbolt released by turning inside lever or outside lever.
 - a. Exception: Cannot release from outside if locked by key from outside.
 - b. Exception: Cannot release from outside if locked by key from inside.
3. Inside lever is always free for immediate egress.
4. Outside lever is rigid when locked.

G. STOREROOM

1. Latchbolt released by turning inside lever, key is required to turn outside lever.
2. Inside lever is always free for immediate egress.
3. No push lock on inside.
4. Outside lever is rigid when locked.

SEE NEXT PAGE FOR DOOR HARDWARE SCHEDULE

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SET 1 – EXTERIOR SINGLE/FAMILY RESTROOM DOORS – DORMTORY

ITEM NAME	MANUFACTURER	ITEM #	COMMENT
Cylinder	Schlage	Everest	All parts compatible with lockset.
Lever	Stanley	Summit (M)	Grade 1 Heavy Duty Function: <u>Dormitory</u>
Electromagnetic Lock	Schlage	Series M400	Provide electrical connection. Provide wall mounted release button on interior side of door.
Silencer	Rockwood	608	All locations
Jamb Seal	Pemko	316AS	
Door Shoe	Pemko	210APK	Compatible with ADA Threshold
Threshold	National Guard	896S	1/2" high x 5" wide. ADA compliant unit with silicone insert
Kick Plate	Rockwood	K1050	Kick Plates: Push side (8"x34" x 0.50") Mop Plates: Pull side (4"x34" x 0.50")
Hinges	Stanley	FBB168	5 x 5, Steel, 5 Kunkle, (3 per leaf)
Closer	Stanley	QDC211	Size 2, Frame header mounted
Latch Guard	Rockwood	TBD	Compatible with hardware

SET 2 – EXTERIOR UTILITY / STORAGE DOORS – STOREROOM

ITEM NAME	MANUFACTURER	ITEM #	COMMENT
Cylinder	Schlage	Everest	Compatible with Lever
Lever	Stanley	Summit (M)	Grade 1 Heavy Duty Function: <u>Storeroom</u>
Silencer	Rockwood	608	All locations
Jamb Seal	Pemko	316AS	
Door Shoe	Pemko	210APK	Compatible with ADA Threshold
Threshold	National Guard	896S	1/2" high x 5" wide. ADA compliant unit with silicone insert
Kick Plate	Rockwood	K1050	Kick Plates: Push side (8"x34" x 0.50") Mop Plates: Pull side (4"x34" x 0.50")
Hinges	Stanley	FBB168	5 x 5, Steel, 5 Kunkle, (3 per leaf)
Closer	Stanley	QDC211	Size 2, Frame header mounted
Latch Guard	Rockwood	TBD	Compatible with hardware

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SET 3 – EXTERIOR STOREROOM DOORS – STOREROOM (DOUBLE DOORS)

ITEM NAME	MANUFACTURER	ITEM #	COMMENT
Cylinder	Schlage	Everest	Compatible with Lever
Lever	Stanley	Summit (M)	Grade 1 Heavy Duty Function: Storeroom
Lever (inactive leaf)	Stanley	Summit (M)	Grade 1 Heavy Duty Rigid dummy. Outside only. To match active lever.
Flush Bolt	Rockwood	550	On inactive leaf Top and bottom
Astragal	Pemko	TBD	Coordinate with Door Manufacturer
Silencer	Rockwood	608	All locations
Jamb Seal	Pemko	316AS	
Door Shoe	Pemko	210APK	Compatible with ADA Threshold
Threshold	National Guard	896S	1/2" high x 5" wide. ADA compliant unit with silicone insert
Kick Plate	Rockwood	K1050	(x2) Kick Plates: Push side (8"x34" x 0.50") (x2) Mop Plates: Pull side (4"x34" x 0.50")
Hinges	Stanley	FBB168	5 x 5, Steel, 5 Kunkle, (3 per leaf)
Closer	Stanley	QDC211	Size 2, Frame header mounted
Latch Guard	Rockwood	TBD	Compatible with hardware

***SECURITY HARDWARE NOTE:**

ALL SECURITY HARDWARE UNDER THIS CATEGORY SHALL BE PROVIDED AND INSTALLED BY OTHERS. GC TO COORDINATE ALL ELECTRICAL CONNECTIONS AS REQUIRED PER THE REQUIREMENTS FOR SECURITY HARDWARE INSTALLATION. LISTED SECURITY HARDWARE IS THE BASIS OF DESIGN AS RECOMMENDED BY ARCHITECT. ACTUAL HARDWARE COULD DIFFER FROM WHAT IS LISTED IN THE HARDWARE SCHEDULE. GC TO COORDINATE WITH SECURITY HARDWARE INSTALLER FOR VERIFICATION OF HARDWARE AND ALL DOOR PREPERATION WORK THAT WILL BE REQUIRED.

END OF SECTION 087100

SECTION 08 90 00 - FIXED LOUVERS AND GRILLES

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. Scope: Provide all labor, materials, equipment and services required to furnish and install the louvers for roofs and exterior walls.
- B. This Section includes the following:
 - 1. Fixed, drainable extruded-aluminum louvers with insect screen for roof louver application.
 - 2. Fixed, drainable galvanized-steel louvers (with security screen) for wall louver application.
 - 3. Insect screens for wall/soffit application.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 07 Section "Joint Sealant".
 - 3. Division 07 Section "Sheet Metal Flashing and Trim".
 - 4. Division 09 Section "Painting".
 - 5. Division 23 Sections for louvers and vents that are a part of mechanical equipment.

1.3 SUBMITTALS

- A. Prior to installation, submit to the Architect for review the following:
 - 1. Manufacturer's specifications, certified test data, installation instruction.
 - 2. Shop drawings for fabrication and erection. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.
 - 3. Physical sample (full size) demonstrating louver construction and all colors for Architect's selection.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 JOB CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

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PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis-of-design product.

2.2 DRAINABLE EXTRUDED-ALUMINUM LOUVERS

- A. Product/manufacturer: The basis-of-design is Drainable Aluminum Louver Model No. K609HP as manufactured by Airlite Company, LLC. Acceptable manufacturers are as follows:
- a. Airlite Company LLC (basis-of-design).
 - b. Architectural Louvers.
 - c. Ruskin Company.
 - d. L & L Louvers.
- B. Description:
1. Material: Extruded Aluminum (Alloy 6063-TS)
 2. Louver depth: 4-inch.
 3. Blade angle: 49 degrees drainable blades
 4. Percent free area: 48.9 percent.
 5. Finish: 2-coat Fluoropolymer, Kynar 500 to comply with performance requirements of AAMA 2605. Color as selected by the Architect.
 6. Provide with aluminum insect screen, 18"x16" (1.4 x1.6 mm) mwsh, 0.012 inch (0.30) wire on backside of louver.
 7. Provide sill flashing, color to match louver color
 8. Mounting: Provide continuous perimeter angle clip or flange whichever applicable.
 9. Size and shape: as indicated in drawings. Provide brick vent of same quality for louver size smaller than 12"x12".

2.3 DRAINABLE GALVANIZED-STEEL LOUVERS

- A. Product/manufacturer: The basis-of-design is Drainable Galvanized Steel Louver Model No. FCB6774 as manufactured by Airlite Company, LLC. Acceptable manufacturers are as follows:
- a. Airlite Company LLC (basis-of-design).
 - b. Architectural Louvers.
 - c. Ruskin Company.
 - d. L & L Louvers.
- B. Description:
1. Material: Galvanized steel, 16 ga. frame, 20 ga. blade.
 2. Louver depth: 4-inch.
 3. Blade angle: 43 degrees drainable blades and head.
 4. Percent free area: 43.9 percent.
 5. Finish: 2-coat Fluoropolymer, Kynar 500 to comply with performance requirements of AAMA 2605. Color as selected by the Architect.
 6. Provide with stainless steel insect screen, 18"x18" (1.4x1.4 mm) mesh, 0.009 inch (0.23 mm) wire on backside of louver.
 7. Provide sill flashing, color to match louver color

8. Mounting: Provide continuous perimeter angle clip or flange whichever applicable.
9. Size and shape: As indicated in drawings. Provide brick vent of same quality for louver size smaller than 12"x12".

2.4 INSECT SCREEN VENTILATION IN WALL/SOFFIT

- A. Description: stainless steel insect screen, 18"x18" (1.4x1.4 mm) mesh, 0.009 inch (0.23 mm) wire in wall/soffit for attic ventilation as shown on the drawings. Attach insect screen to plywood wall/soffit sheathing and provide fiber cement trim board over screen edge.

2.5 COMMERCIAL DOOR LOUVERS

- A. Product/manufacturer: The basis-of-design is Drainable Galvanized Steel Louver Model No. FCB6774 as manufactured by Airo-lite Company, LLC. Acceptable manufacturers are as follows:
 - a. TruDoor (basis-of-design).
 - b. Commercial Doors USA Fire Door.
 - c. Coordinate with Door and Frame manufacturer

- B. Description:
 1. 18 gauge CRS frame and 20 gauge blades
 2. Standard Bronze or Gray Finish
 3. Mitered and Welded Corners
 4. Free Flow Area: 50% free
 5. Reverse "Y" blades are frame supported at 1" increments, with blocked vision design
 6. Self-attaching, vandal-proof design
 7. Single side mounting for non corridor exposure with fastening screws included
 8. Designed for use with 1-3/4" doors only
 9. Coordinate sizes with HVAC drawings - Order size is equal to door cutout size

Optional features at additional cost and lead time (3-4 Weeks):

10. Provide Mesh insect screen on all exterior doors
11. Provide Fusible Link Louver as required at any fire rated doors
24" x 24" Max Louver Size; Bottom of Door Only; up to 90 Minute Rating.
Glass can not be used in conjunction with louvers in fire-rated doors
12. Custom sizes up to 36" x 72" - as noted on drawings
13. Special powder coat colors (White, Black, Beige, Red, Silver) - as noted on drawings
14. Galvanneal or Aluminum material – as noted on drawings

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and place louver units plumb, level and in proper alignment with adjacent work.
- B. Anchorage:
 1. Use concealed anchorage. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 2. Anchors and other methods of attachment shall be security type masonry anchors and shall be to the approval of the Architect.

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- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes so that there is no evidence of corrective work. Return items which cannot be refinished in field shop, make required alterations, and refinish entire unit, or provide new units.
- D. Provide concealed gaskets, flashings, joint fillers, and install as work progresses to make installations weathertight.

3.2 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 09 29 00 - GYPSUM BOARD

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the gypsum board.
- B. This Section includes the following:
 - 1. Interior gypsum wall board, rated and non-rated.
 - 2. Interior gypsum ceiling board, rated and non-rated.
 - 3. Substrate gypsum board, for rated UL assemblies.
 - 4. Auxiliary materials and accessories.
- C. Related Sections include the following:
 - 1. Division 06 Section "General Carpentry".
 - 2. Division 06 Section "Sheathing".
 - 3. Division 07 Section "Thermal Insulation".
 - 4. Division 09 Section "Resilient Base and Accessories".
 - 5. Division 09 Section "Painting".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Prior to installation, submit to the Architect for review the following:
 - 1. Manufacturer's literature fully describing each product named which shall include, but not be limited to, the manufacturer's name and catalog number for each item.
 - 2. Accompanying the materials list, submit two (2) copies of the manufacturer's current recommended method of installation for each item.
 - 3. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. References:
 - 1. United States Gypsum Company (Gypsum Construction Handbook)
 - 2. Gypsum Association (GA) publications.
- B. Fire-test-response characteristics: Where fire-rated assemblies are indicated, provide materials and construction bearing the UL Classification Mark, identical to those of assemblies tested for fire resistance per ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction. C. Single-source responsibility:

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1. Obtain steel framing members for gypsum board assemblies from a single manufacturer.
2. Obtain each type of gypsum board and other panel products from a single manufacturer.
3. Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.
- C. Handle material to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.6 JOB CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Ventilate building spaces as required for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General:
 1. Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 2. Complying with designated listed UL testing for fire-rated assembly applications.
 3. 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:
 - a. Georgia Pacific
 - b. USG.

c. National Gypsum/Gold Bond.

B. Gypsum Wallboard for application on rated ceiling/floor and wall assembly:

1. 5/8" Fire rated: Conform to "Specification for Gypsum Drywall", ASTM C36 for type "X" gypsum board.

2.3 SUBSTRATE SYSTEM GYPSUM BOARD

A. General:

1. Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Complying with ASTM D3273 for mold resistance.
3. Complying with designated listed UL testing for fire-rated assembly applications.

B. Application: Fire rated wall UL-Assembly that is used as substrate for an exterior wall veneer system.

1. Deflection of the substrate systems shall not exceed L/240.
2. Basis-of-Design: Dens-Glass Fireguard (ASTM C1177) as manufactured by Georgia Pacific, or an approved equal.
3. The substrate systems shall be engineered with regard to structural performance by others.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc
2. Shapes:
 - a. Corner bead: USG #200 series.
 - b. Bullnose bead: Dur-A-Bead/
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General:

1. Comply with ASTM C 475/C 475M, "Joint Treatment Materials for Gypsum Wallboard Construction".
2. Complying with designated listed UL testing for fire-rated assembly applications.

B. Joint Reinforcing Tape: Perf-A-Tape Reinforcing Tape

C. Joint Compound for Interior Gypsum Wallboard: USG All-Purpose Joint Compound. For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.

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4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealant."
- E. Thermal and Sound Attenuation Insulation: As specified in Division 07 Section "Thermal Insulation."
- F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered

edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
- I. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. Bullnose Bead: Use at outside corners.
 - 3. LC-Bead: Use at exposed panel edges
 - 4. L-Bead: Use where indicated

SECTION 09 29 00 – GYPSUM BOARD

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- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edge.
- E. Aluminum Trim: Install in locations indicated on Drawings

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile
 - 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 61 00 - CONCRETE FLOOR SEALER

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the concrete floor sealer. The product is only for application to those floors that will not receive an additional finish material (e.g.: Tile).
- B. This Section includes Concrete Floor Sealer Solution.
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR SEALER

- A. Product/manufacturer:
 - 1. CT Densifyer 629 as manufactured by Chemprobe Coating Systems (a Division of Tnemec).
 - 2. Duro-Nox as manufactured by Nox-Crete.
 - 3. Aquapel as manufactured by L & M Construction Chemicals, Inc.
- B. Description: Sodium silicate clear, penetrating, water based sealer for densifying (harden and seal) and dustproofing. The solution penetrates the substrate and chemically reacts to increase density at the surface and dustproof concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare the substrate the substrate and install the product in strict accordance with the original design and the manufacturer's recommendations.
- B. Prepare substrate.
 - 1. Surface shall be free of oil, grease and any extraneous matter which could interfere with product's penetration. Pressure wash the concrete substrate to remove contamination, lose or broken cement paste and aggregate. Remove or rework all loose or broken mortar. After pressure washing, the substrate shall readily absorb water and not show any signs of water beading.

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C. Application:

1. Do not dilute or thin.
2. Apply using a low pressure rotary or gear pump sprayer with a fan tip. Applications using a commercial grade pump up spray tank, roller or brush are also acceptable (depending on the substrate and project circumstances; follow manufacturer's directions). Airless paint sprayers are not acceptable.
3. Allow product to fully cure prior to putting the substrate into service.
4. Application rate of first coat: 300 to 350 sq ft/gallon.
5. Apply using a uniform spray pattern overlapped slightly on each pass. Apply material sufficiently for a wet appearance but do not leave excess material stand in low areas. Broom out or squeegee excess material as soon as possible.
6. After completing the first coat allow at least one hour then apply a second coat at 350 to 400 sq ft/gallon.

END OF SECTION 09 61 00

SECTION 09 67 23 - HIGH PERFORMANCE EPOXY FLOORING

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the epoxy floor coating and additionally named products.
- B. This Section includes High Performance Epoxy Floor Coating.
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".

1.3 SUBMITTALS

- A. Prior to fabrication, submit to the Architect for review the following:
 - 1. Manufacturer's literature fully describing each product, its proper installation and general recommendations for slip-retardant epoxy coating floor coating for this Project.
 - 2. Physical sample (each product): All colors, patterns and textures for Architect's selections.
 - a. Minimum size: 4" x 4".
 - 3. Material certificates signed by manufacturer certifying that the slip-retardant epoxy coating floor coating complies with requirements specified herein.
 - 4. Maintenance instructions: Manufacturer's written instructions for recommended maintenance practices.

1.4 QUALITY ASSURANCE

- A. Engage an experienced installer or applicator who has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.
- B. Single-source responsibility: Obtain epoxy floor coating materials including primers, slipretardant aggregates, resins, hardening agents and finish coats, from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.
- B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

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1.6 JOB CONDITIONS

- A. Environmental conditions: Comply with epoxy coating manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect work.
- B. Lighting: Permanent lighting shall be in place and working before installing epoxy floor coating.
- C. Concrete substrate:
 - 1. Concrete shall have been water-cured or cured using sodium silicate curing compounds only. Other types of curing compounds are not acceptable unless the epoxy flooring manufacturer has given written approval.
 - 2. Concrete shall have been cured for a minimum of 28 days.
 - 3. On-grade floors shall have functioning vapor retarder beneath slab.

PART 2 - PRODUCTS

2.1 EPOXY FLOOR COATING

- A. Product/manufacturer:
 - 1. Ceramic Carpet No. 400 Quartz Broadcast Flooring System (Double Broadcast) as manufactured by General Polymers.
 - 2. Deco-Tread as manufactured by Tnemec.
 - 3. FloroQuartz as manufactured by Flrock.
 - 4. Dur-A-Quartz (Q28 fine grade) as manufactured by Dur-A-Flex.
- B. Description: Seamless application.
 - 1. 1/8" Decorative Broadcast Epoxy Flooring System
 - 2. Components:
 - a. Primer: No. 3579 Penetrating Primer.
 - b. Binder resin: No. 3561 Epoxy Resin Glaze.
 - c. Seed: No. 5900F Ceramic Granules (Fine Grade).
 - d. Grout: No. 3744 High Performance CR Epoxy.
 - e. Top coat: No. 400-CRS, 3744S High Performance CR Epoxy Satin.
 - 3. Physical Properties:
 - a. Resistance elevated temperatures (MIL-D-3134J): No slip or flow at required temperature of 158 degree F.
 - b. Hardness at 24 hours Shore D (ASTM D-2240): 70/65.
 - c. Compressive strength (ASTM C-579): 11,000 psi.
 - d. Tensile strength:
 - 1) ASTM C-307: 1,800 psi.
 - 2) ASTM D-638: 6,000 psi.
 - e. Flexural strength:
 - 1) ASTM C-580: 3,500 psi.
 - 2) ASTM D-790: 10,000 psi.
 - f. Adhesion (ACI 503R): 350 psi, 100% concrete failure.
 - g. Abrasion resistance J (ASTM D-4060, CS-17 Wheel): 70-90 milligrams lost.

- h. Flammability (ASTM D-635): Self-extinguishing over concrete.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where epoxy floor coating is to be installed and modify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in conformance with the Contract Documents.

3.2 PREPARATION

- A. Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
- B. Concrete: Prepare in accordance with the manufacturer's instructions. Remove laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

3.3 APPLICATION

- A. Install all products in strict accordance with the original design and the manufacturer's recommendations.
- B. Apply each coating of the floor coating system to provide a uniform, monolithic flooring surface.

3.4 CURING, PROTECTION AND CLEANING

- A. Cure epoxy floor coating materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION 096723

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SECTION 09 91 00 - PAINTING

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. Scope: Provide all labor, materials, equipment, and services required to furnish and apply the painting and staining materials.
- B. This Section includes Painting and Staining Materials.
- C. Related Sections include the following:
 - 1. Division 04 Section "Architectural Concrete Masonry".
 - 2. Division 06 Section "General Carpentry".
 - 3. Division 06 Section "Sheathing".
 - 4. Division 06 Section "Millwork".
 - 5. Division 07 Section "Mineral Fiber Cement Board".
 - 6. Division 08 Section "Hollow Metal Doors and Frames".
 - 7. Division 09 Section "Gypsum Board".
 - 8. Division 09 Section "Epoxy Coatings".
- D. The term "paint" as used herein means coating systems materials, which includes primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- E. Paint exposed surfaces whether or not colors are designated in any "schedule", except where natural finish of material is specifically noted as not to be painted. Where items or surfaces are not specifically mentioned, paint these same as adjacent similar materials or areas. If color or finish is not designated, Architect will select the colors.
- F. All surfaces that are left unfinished by the requirements of other Sections, whether specifically mentioned or not, shall be painted or finished as part of the work covered by this Section.

1.3 SUBMITTALS

- A. Prior to application, submit to the Architect for review the following:
 - 1. Submit a complete list of all materials proposed to be furnished and installed under this portion of the Work. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Architect.
 - 2. In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the Manufacturer of the proposed material.
 - 3. Submit complete set of colors, color designation or formula and finishes for Architect's selections. The Architect has the option of selecting as many colors and finishes from any

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of the various paint or paint related products to be specified here, as he may desire without additional cost to the Owner or the Architect.

4. Submit a complete list of paint colors identified by manufacturer, room and surface location.
 5. After Architect has selected colors and finishes and has furnished a schedule, prepare samples of each color for approval by the Architect before proceeding with this work. These job applied samples shall serve as a minimum acceptable standard for the finished work in color and appearance.
- B. Certification that all standards and requirements have been met. These shall include, but not be limited to:
1. Delivery.
 2. Storage.
 3. Conditions under which the materials were installed.
 4. Product complies with specified requirements.
 5. Specified number coats and mil thickness have been applied.

1.4 QUALITY ASSURANCE

- A. In addition to complying with all pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications", current edition.
- B. Provide finish coats which are compatible with prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing of any anticipated problems using coating systems as specified with substrates primed by others.
- C. Single source: Unless indicated otherwise, obtain all materials from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 JOB CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA STOCK

- A. Provide for Owner storage one unopened 1-gallon can of each color and type used. Provide written list of each color/type used and location with supplier, color name and code.
- B. Provide extra materials that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.

- C. Contractor provide listing of all paint colors used with manufacturer and color designation number or formula.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers:
 - a. Sherwin Williams.
 - b. Duron
 - c. PPG/Porter Paint Company
 - d. ICI Paints
- B. Approved manufacturers for isolated items named will be listed with the product.
- C. In general and with the exception of those manufacturers named for isolated items, numbers and descriptive names used are those of the Sherwin Williams Company and are for the purpose of convenience, identification, and establishing a standard quality for the materials required. Any of the mentioned manufacturers shall be acceptable provided a submittal of finished physical sample, full description and formulation of products, list of all paint colors with color designation number and the surfaces that are to be covered are submitted.
- D. All paints, stains, sealers, oils, thinners, turpentine or other materials required to accomplish the painting and finishing shall be first-quality materials.

2.2 MATERIALS COMPATIBILITY

- A. All paint and stain materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.
- B. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the materials to be thinned.
- C. New paint or stain materials shall be compatible with the existing coatings on existing surfaces.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to the Architect, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.
- B. Correct defects and deficiencies in surfaces which may adversely affect work of this Section.
- C. Commencement of work shall be construed as acceptance of the surfaces and, therefore, the Contractor shall be fully responsible for satisfactory work as required herein.

3.2 PREPARATION OF SURFACES

- A. Remove mildew, by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.

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- B. Gypsum wallboard: Remove contamination and prime to show defects, if any. Paint after defects have been remedied.
- C. Concrete and concrete block:
 - 1. Remove dirt, loose mortar, scale, powder and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to thoroughly dry.
 - 2. Remove stains caused by weathering of corroding metals with a solution of sodium meta-silicate after being thoroughly wetted with water. Allow to thoroughly dry.
 - 3. Apply masonry filler as required to provide even, consistent (filling of voids), with filler material. Methods of application which "bridge" voids will not be acceptable.
- D. Completely mask, remove, or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces but not scheduled to receive paint.
- E. Spot prime all exposed nails and other metals which are to be painted with emulsion paints, using a primer recommended by the manufacturer of the coating system.
- F. Adequate illumination shall be provided in all areas where painting and staining operations are in progress.
- G. Efflorescence on any area that is scheduled to be painted shall be removed.
- H. Clean shop coats that become marred. Touch-up with specified shop coats.

3.3 PREPARATION OF WOOD SURFACES

- A. Wipe off dust and grit from miscellaneous wood items and millwork prior to priming. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats.
- B. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off.
- C. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides.
- D. When transparent finish is required, use spar varnish for back-priming.
- E. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat.
- F. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler.
- G. Sandpaper smooth when dried.
- H. Wood Doors: Pre-finished.
- I. Prior to finishing glue-laminated beams, wash down surfaces with solvent and remove grease and dirt.

3.4 PREPARATION OF METAL SURFACES

A. Steel and iron:

1. Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing.
2. Clean unprimed steel surfaces by washing with solvent. Apply at treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
3. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. (Prime steel including shop primed steels.)

B. Galvanized metal:

1. Clean all surfaces thoroughly with solvent until they are completely free from dirt, oil, and grease.
2. Thoroughly treat the cleaned surface with phosphoric acid etch.
3. Remove all excess etching solution and allow to dry completely before application of paint.

C. Remove surface contamination and oils from zinc coated surfaces and prepare for priming in accordance with metal manufacturer's recommendations.

D. Other metals:

1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.
2. Allow to dry thoroughly before application of paint.

3.5 APPLICATION

A. All materials shall be applied under adequate illumination, evenly spread, and smoothly flowed on with the proper type and size of brushes, roller covers, bucket grids, and spray equipment to avoid run, sags, holidays, brush marks, air bubbles, and excessive roller stipple.

B. Coverage and hide shall be complete. When color, stain, mark of any kind, dirt or undercoats show through the final schedule coat of paint to the surface, it shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage at no additional cost to the Owner.

C. Do not add thinners to the paint or paint related products.

D. Finished areas shall be free from sags, runs, crawls, brush marks, and other defects.

E. Touch-up painting as required to provide smooth, even finish prior to final acceptance of work.

F. Do not apply finishes on surfaces that are not sufficiently dry.

G. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.

H. Where clear finishes are required, ensure tint fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.

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- I. Environmental conditions:
 - 1. Comply with the manufacturer's recommendations as to environmental conditions under which the coating systems may be applied.
 - 2. Do not apply paint in areas where dust is being generated.
- J. Moisture content:
 - 1. Use a moisture meter approved by the Architect to test surfaces.
 - 2. Do not apply the initial coating until moisture meter reading is within normal limits recommended by the paint materials manufacturers.
- K. Defects: Sand and dust between coats to remove all defects visible to the unaided eye from a distance of five feet.
- L. Color of undercoats: Slightly vary the color of succeeding coats.

3.6 OBSERVATION OF WORK

- A. Do not apply additional coats until completed coat has been observed and approved by the Architect.
- B. Only observed and approved coats of paint will be considered in determining the number of coats applied.

3.7 DRY FILM THICKNESS

- A. DFT represents Dried Film Thickness. It shall be checked on metal surfaces with a Nordson Mikrotest Dry Film Thickness Gauge. For other surfaces, a Tooke Dry Film Thickness Gauge shall be used. Surfaces may also be checked while surface is wet by using a Nordson Wet Film Gauge. Should an average of three readings out of five show film less than specified, additional materials should be applied until the surface has the proper amount of material.

3.8 REINSTALLATION OF REMOVED ITEMS

- A. Following completion of painting in each space, promptly reinstall all items removed for painting, using only workmen skilled in the particular Trade.

3.9 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Coordinate with the requirements of Divisions 23 and 26.
- B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.
- C. Finish paint primed equipment to color selected.
- D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bar ducts, hangers, brackets, collars and supports, except where items are plated or covered with a pre-finished coating.
- E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
- F. Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels.

- G. Paint exposed conduit and electrical equipment occurring in finished areas. Color and texture to match adjacent surfaces.
- H. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

3.10 STENCILING RATED WALLS

- A. Stencil both sides of all corridor partitions, smoke, fire, horizontal exits, exit enclosures, and other rated partitions with permanent 2" high letters.
 - 1. Color: Bright Red.
 - 2. Identify the name and hour rating of the partition approximately 8" above the ceiling every 25' on both sides of the partition.
 - 3. Identify once in each space having fire-rated or smoke walls.
 - 4. Identify walls as applicable:
 - a. 1 HOUR FIRE.
 - b. 2 HOUR FIRE.
 - c. 1 HOUR SMOKE.
 - d. 2 HOUR FIRE AND SMOKE.
 - e. 1 HOUR SMOKE TIGHT CORRIDOR.
 - f. NON-RATED SMOKE TIGHT CORRIDOR.
 - g. Other identifying language as necessary.
 - 5. Identification shall be above any decorative ceiling and in concealed spaces and shall be acceptable to the authority having jurisdiction.

3.11 CLEANING

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.
- B. During progress of work, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Upon completion of work, leave premises neat and clean, to the satisfaction of the Architect.

3.12 PAINT SCHEDULE – EXTERIOR

- A. All exposed metal surfaces not otherwise provided for below.
 - 1. These shall include, but not be limited to, the following:
 - a. Hollow metal doors and frames.
 - b. Metal flashing (not already prefinished).
 - c. Piping and conduit associated with mechanical and electrical.
 - d. Bollards.
 - e. Steel lintels.
 - f. Any edge or surface exposed to view or the weather.
 - 2. Paint application:
 - a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
 - b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.

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3. Prime Coat: Primer, rust-inhibitive, water based:
 - a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 4. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 5. Topcoat: Light industrial coating, exterior, water based eggshell:
 - a. S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.
 6. Verify with each metal item that shop prime coats are compatible with finish field painting.
- B. CMU Substrates
1. Block Filler: Block filler, latex, interior/exterior:
 - a. S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal.
 2. Intermediate Coat: Latex, exterior, matching topcoat.
 3. Topcoat: Latex, exterior, satin:
 - a. S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
- C. Wood Substrates (Plywood and Trims) - Paint
1. Prime Coat: Primer, latex for exterior wood:
 - a. S-W Exterior Latex Primer, B42, at 4.0 mils wet, 1.4 mils dry, per coat.
 2. Intermediate Coat: Latex, exterior, matching topcoat.
 3. Topcoat: Latex, exterior, satin:
 - a. S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
- D. Wood Substrates (Plywood and Trims) – Stain
1. Solid Stain:
 - a. 3 coats SW WoodScapes Solid Color Stain, A-15 series (Exterior Acrylic Solid color).
 2. Clear/Transparent Stain: Apply sanding sealer as recommended by paint manufacturer:
 - a. 1 coat SW Wood Classics Oil Stain, A49 Series (degree of stain as selected by the Architect).
 - b. 2 coats SW Wood Classics FastDry Oil Varnish, Satin A66 Series.
- E. Cementitious Siding and Trims.
1. Prime Coat: Primer sealer, latex:
 - a. S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 wet, 3.2 mils dry.
 2. Prime Coat: Latex, exterior, matching topcoat.
 3. Intermediate Coat: Latex, exterior, matching topcoat.
 4. Topcoat: Latex, exterior, satin:
 - a. S-W A-100 Exterior Latex Satin, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

3.13 PAINT SCHEDULE – INTERIOR (DRY AREA ONLY)

- A. All exposed metal surfaces not otherwise provided for below.
 - 1. These shall include, but not be limited to, the following:
 - a. Hollow metal doors and frames
 - b. Panel boxes
 - c. Miscellaneous metal
 - d. Exposed metal structure and framing
 - e. Grilles and diffusers
 - f. Exposed sheet metal and ductwork
 - g. Access doors
 - h. Exposed piping and conduit
 - 2. Paint application:
 - a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
 - b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.
 - c. Verify with each metal item that shop prime coats are compatible with finish field painting.
 - 3. Prime Coat: Primer, rust-inhibitive, water based:
 - a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - 4. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - 5. Topcoat: Light industrial coating, exterior, water based eggshell:
 - a. S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.
- B. CMU Substrates
 - 1. Block Filler: Block filler, latex, interior/exterior:
 - a. S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior, eggshell:
 - a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
- C. Wood Substrates
 - 1. Prime Coat: Primer sealer, latex, interior:
 - a. S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior, eggshell:
 - a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

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D. Gypsum Board Substrates (Ceilings/Walls)

1. Prime Coat: Primer, latex, interior:
 - a. S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
2. Intermediate Coat: Latex, interior, matching topcoat.
3. Topcoat: Latex, interior, eggshell:
 - a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

3.14 PAINT SCHEDULE – EPOXY - INTERIOR (WET AREAS) AND AS NOTED ON DRAWINGS

A. All exposed metal surfaces not otherwise provided for below.

1. These shall include, but not be limited to, the following:
 - a. Hollow metal doors and frames
 - b. Panel boxes
 - c. Miscellaneous metal
 - d. Exposed metal structure and framing
 - e. Grilles and diffusers
 - f. Exposed sheet metal and ductwork
 - g. Access doors
 - h. Exposed piping and conduit
2. Paint application:
 - a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
 - b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.
 - c. Verify with each metal item that shop prime coats are compatible with finish field painting.
3. Prime Coat: Primer, rust-inhibitive, water based:
 - a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
4. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
5. Topcoat: Light industrial coating, interior, water based, eggshell:
 - a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. CMU Substrates

1. Block Filler: Block filler, latex, interior/exterior:
 - a. S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3. Topcoat: Light industrial coating, interior, water based, eggshell:
 - a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Wood Substrates

1. Prime Coat: Primer sealer, latex, interior:
 - a. S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3. Topcoat: Light industrial coating, interior, water based, eggshell:
 - a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

D. Gypsum Board Substrates (Ceilings/Walls)

1. Prime Coat: Primer sealer, latex, interior:
 - a. S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3. Topcoat: Light industrial coating, interior, water based, eggshell:
 - a. S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

E. CMU Interior Wet Areas

1. Block Filler: Block filler, latex, interior/exterior:
 - a. 1 to 2 coats Kem Cati-Coat HS Epoxy at 10.0-20.0 mils dry, as required to fill voids and provide a continuous substrate.
2. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
 - a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

F. Previously Painted Substrates:

1. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
 - a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

3.15 PROTECTIVE ANTI-GRAFFITI GENERAL (AS NOTED ON DRAWINGS)

A. Surface Preparation:

1. General: Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material. Any paint that is peeling, flaking, cracking, blistering or lifting must be removed to ensure adequate adhesion.
2. Concrete and Masonry: Concrete and Masonry: For surface preparation, refer to SSPC-SP13/NACE 6, or ICRI No. 310.2R, CSP 2-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners.
Previously Painted: If previously painted surface is in sound condition, clean surface of all foreign material. Smooth, hard or glossy coatings should be dulled by abrading the surface. Apply a test area, allowing to dry one week before testing adhesion. If adhesion

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is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary.

3.16 PROTECTIVE ANTI-GRAFFITI SILOXANE

A. Bare Concrete Substrates:

1. Topcoat: Protective (Anti-Graffiti) Siloxane, Clear, Semi-Gloss
 - a. 1K Siloxane Anti-Graffiti Coating 6.0 to 9.0 mils dry.

B. Porous Masonry and Stone:

1. Base Coat: Anti-Graffiti Coating Reduced 10% with Mineral Spirits
2. Topcoat: Protective (Anti-Graffiti) Siloxane, Clear, Semi-Gloss
 - a. 1K Siloxane Anti-Graffiti Coating 6.0 to 9.0 mils dry.

3.17 PROTECTIVE ANTI-GRAFFITI URETHANE

A. CMU Interior/Exterior

1. Block Filler: Block filler, latex, interior/exterior:
 - a. S-W Pro Industrial Heavy-Duty Block Filler, B42W150, at 10 mils dry, per coat.
2. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
 - a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

END OF SECTION 09 91 00

SECTION 09 96 56 - EPOXY COATINGS

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and apply the epoxy coatings.
- B. This Section includes Epoxy Coatings on Walls and Ceilings.
- C. Related Sections Include the following:
 - 1. Division 04 Section “Architectural Concrete Masonry”.
 - 2. Division 06 Section “Sheathing”.
 - 3. Division 06 Section “General Carpentry”.
 - 4. Division 09 Section “Gypsum Board”.
 - 5. Division 09 Section “Painting”.

1.3 REFERENCE

- 1. ASTM International (ASTM):
 - a. ASTM C882 Standard Test Method for Bond Strength of Epoxy Resin Systems Used With Concrete By Slant Shear
 - b. ASTM D570 Standard Test Method for Compressive Properties of Rigid Plastics
 - c. ASTM D638 Standard Test Method for Tensile Properties of Plastics.
 - d. ASTM D645 Standard Test Method for Thickness of Paper and Paperboard.
 - e. ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics.
 - f. ASTM D2240 Standard Test Method for Rubber Property Durometer Hardness.
 - g. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - h. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

1.4 SUBMITTALS

- A. Prior to applications, submit to the Architect for review the following:
 - 1. A complete list of all materials proposed to be furnished and installed under this portion of the Work. This shall in no way be construed as permitting substitution of materials for those specified or approved for this work by the Architect.
 - 2. In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.

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3. A complete set of available colors for the Architect's selection. Colors shall be coordinated with those of Section 099100, "Painting". The Architect shall have the option of selecting as many colors from any of the various products to be specified here, as he may desire without additional cost to the Owner or the Architect.
 4. Prior to applying any epoxy wall coating, it shall be required that the applicator paint a
 5. sample area (a minimum of 50 square feet) of the specified epoxy wall coating. This shall be accomplished in the presence of a representative of the manufacturer. This representative must submit certification to the Architect that the sample coating was applied properly and that the sample sets the standard for the Project. Only upon receipt of this certification will the epoxy be allowed to be applied.
- B. Maintenance Material Submittals:
1. Specifier Note: Specify by type and quantity extra stock materials to be provided for the Owner's use in facility operation and maintenance. Specify extra stock material characteristics in PART 2.
 2. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
- C. Certification that all standards and requirements have been met. These shall include, but not be limited to:
1. Delivery.
 2. Storage.
 3. Conditions under which the materials were installed.
 4. Product complies with specified requirements.
 5. Specified number coats and mil thickness have been applied.

1.5 QUALITY ASSURANCE

- A. Provide finish coats which are compatible with prime coats used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Provide barrier or remove and re-prime. Notify the Architect in writing of any anticipated problems using coating systems as specified with substrates primed by others.
- B. Manufacturer Qualifications:
1. 10 year experience manufacturing components similar to or exceeding requirements of project.
 2. Having sufficient capacity to produce and deliver required materials without causing delay in work.
 3. Capable of providing field service representation during construction.
- C. Installer: Acceptable to the manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials to the job site in their original unopened containers with all labels intact and legible at time of use.
- B. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of epoxy wall coating materials and related equipment.

- C. Use all means necessary to ensure the safe storage and use of epoxy wall coating materials and the prompt and safe disposal of waste.
- D. Use all means necessary to protect the materials before, during, and after application and to protect the installed work and materials of all other Trades.
- E. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers:
 - a. Porter/International
 - b. Benjamin Moore and Company
 - c. ICI Paints
 - d. Sherwin Williams
 - e. Pittsburgh Paint
 - f. Elite Crete Systems, Inc.
- B. Approved manufacturers for isolated items named will be listed with the product.
- C. In general and with the exception of these manufacturers named for isolated items, numbers and descriptive names used are those of Porter Paint Company and are for the purpose of convenience, identification, and establishing a standard of quality for the materials required.
- D. Any of the mentioned manufacturers shall be acceptable provided a submittal of finished physical sample, full description and formulation of products, and the surfaces that are to be applied to are submitted.
- E. All materials shall be first-quality materials.
- F. Color: as selected by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES, GENERAL

- A. Mask surfaces, finishes and materials not receiving wall coating, to provide true juncture lines.
- B. Spot prime all exposed nails and other metals which are to be painted with emulsion paints, using a primer recommended by the manufacturer of the coating system.
- C. Cleaning:
 - 1. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.
 - 2. Schedule work so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

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3.2 EPOXY WALL COATING APPLICATION

- A. Application shall be in strict accordance with the manufacturer's direction, this Contract Documents, and the approved submittals.
- B. Exposed piping, hangers, supports, and other exposed metal suspended from the ceiling shall receive epoxy coating when the ceiling is so designated to receive epoxy coating.
- C. Drying:
 - 1. Allow sufficient drying time between coats.
 - 2. Modify time period as recommended by the material manufacturer to suit adverse weather conditions.
- D. Environmental conditions:
 - 1. Comply with the manufacturer's recommendations as to environmental conditions under which the coating systems may be applied.
 - 2. Do not apply paint in areas where dust is being generated.
- E. Moisture content:
 - 1. Use a moisture-meter approved by the Architect to test surfaces.
 - 2. Do not apply the initial coating until moisture-meter reading is within limits recommended by the paint materials manufacturer.
 - 3. Sand and dust between coats to remove all defects visible to the unaided eye.

3.3 INSPECTION

- A. Do not apply additional coats until completed coat has been reviewed by the Architect.
- B. Only reviewed coats of paint will be considered in determining the number of coats applied.

3.4 DRY MIL THICKNESS

- A. Apply all coatings to the dry mil thickness indicated in the "Paint Schedule".
- B. Provide and use a "Tooke Dry Film Thickness Gauge", or other gauge approved by the Architect, to prove the dry mil thickness of paint applied.

3.5 REINSTALLATION OF REMOVED ITEMS

- A. Following completion of epoxy work in each space, promptly reinstall all items removed for application of epoxy, using only workmen skilled in the particular Trade.

3.6 CLEANING UP

A. General:

1. During progress of the Work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose.
 2. Prevent accidental spilling of materials and, in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.
- B. Prior to final inspection: Upon completion of this portion of the Work, visually inspect all surfaces and remove all epoxy and traces of epoxy from surfaces not scheduled to be covered.

3.7 EPOXY COATING SCHEDULE

A. Concrete Block:

1. 1 coat Sherwin Williams Heavy Duty Block Filler, B42W46,
2. 1 coat Sherwin Williams 2K Waterbased Urethane Anti-Graffiti Coating, B65 Series, 3.0 mils DFT
3. 1 coat Sherwin Williams 2K Waterbased Urethane Anti-Graffiti Coating, B65 Series, 3.0 mils DFT

B. Plywood Ceilings:

1. 1 coat Sherwin Williams Premium Wall and Wood Primer
2. 2 coats Pro Industrial Waterbased Catalyzed Epoxy, B73-300 Series

C. Gypsum Board: Ceilings/Walls:

1. 1 coat Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600
2. 2 coats Sherwin Williams Pro Industrial Waterbased Catalyzed Epoxy, B73-300 Series

END OF SECTION 09 96 56

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SECTION 10 14 00 - SIGNAGE

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the signage.
- B. This Section includes Wall/Room Signage Plaques.

1.3 SUBMITTALS

- A. Prior to installation, submit to the Architect for review the following:
 - 1. Manufacturer's literature fully describing each:
 - a. Product and its fabrication.
 - b. Details of construction relative to materials, dimensions of individual components, profiles and finishes.
 - c. Attachment and installation instructions.
 - 2. Shop drawings, fully dimensioned, showing fabrication and erection of signs. Include plans, elevations, large-scale sections of typical members and other components.
 - a. Show anchors, grounds, layout, reinforcement, accessories and installation details.
 - 3. Physical sample for the Architect's selection of color.
 - 4. Manufacturer's certification that Braille is correct for verbiage.
 - 5. Schedule and layout of all signs (each location), message list and graphics.

1.4 QUALITY ASSURANCE

- A. Signage shall be of type and construction as approved by American with Disabilities Act (ADA).
- B. Sign fabricator: Firm experienced in producing signs similar those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- C. Single-source responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- D. The Drawings indicated sizes, profiles, dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

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1.5 JOB CONDITIONS

- A. Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.
 - a. Best Manufacturing Sign Systems (basis of design).
 - b. ASI
 - c. Gemini Inc

2.2 WALL SIGNAGE PLAQUES:

- A. Description:
 - 1. Sign style type: Best HC300 ADA System.
 - 2. Materials:
 - a. Interior applications: Type Melamine Plastic "MP" two-color, scratch resistant, non-static, fire retardant, washable, 3-ply melamine surface laminate. Nonglare surface with phenolic core which shall be painted a contracting color after artwork has been carved into the surface.
 - b. Exterior applications: Type Fiberglass "FG" non-corrosive, 3-ply laminate with contrasting core color, UV inhibitors, non-glare surface and 20 year life expectancy. Fire resistant.
 - 3. Color: Selected by the Architect from the manufacturer's standard colors.
 - 4. Letter style: Helvetica Medium, upper and lower case.
 - 5. Mounting: Counter sunk holes for screw attachment. Screw heads shall be flush with the surface of the plaque and shall be colored to match the plaque.
 - 6. Graphic and copy:
 - a. Sign copy and graphic shall be as designated by the Architect.
 - b. Size of sign shall be as recommended by the manufacturer to accommodate the wording and the graphic.
 - c. ADA Compliance: Braille copy shall be Standard English Braille, Grade II.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the approved submittals, the Contract Documents, and manufacturer's instructions.
- B. Once installed, the signs shall be level and true. In addition, location and height on wall shall be in accordance with ADA requirements.

END OF SECTION 10 14 00

SECTION 10 28 00 - TOILET, BATH AND LAUNDRY ACCESSORIES

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. Public-use washroom accessories.
 - 2. High Velocity Warm-air dryers.
 - 3. Childcare accessories.
 - 4. Under-lavatory guards.
 - 5. Custodial accessories.
- B. Related Sections include the following:
 - 1. See Electrical for connections to accessories. (As required)

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

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

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1.5 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359inch (0.9-mm) minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamperand-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 1/4 inch (6.0 mm) thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

- a. Bobrick Washroom Equipment, Inc.
- b. Bradley Corporation.
- c. American Specialties, Inc.
- d. A & J Washroom Accessories, Inc.
- e. General Accessory Manufacturing Co. (GAMCO).

D. Toilet Tissue (Jumbo Roll) Dispenser:

1. Basis-of-Design Product: Bobrick; Model B-2892.
2. Description: Dual jumbo-roll dispenser
3. Mounting: Surface mounted.
4. Capacity: Designed to hold (2) standard rolls up to 10" diameter with 3-inch diameter core. Core adapters accept 2 1/4-inch diameter core.
5. Material and Finish: Stainless steel, alloy 18-8, type 304 with No. 4 Satin finish. Inside mechanism of durable ABS with sliding bottom access panel to allow dispensing from one roll at a time. Equal products by other manufacturers meeting specifications requirements will be accepted.
6. Owner provided, Contractor installed.

E. Paper Towel Dispenser (Concession Room Sink):

1. Basis-of-Design Product: Bobrick; Model B-262
2. Description: C-Fold / Multi-Fold towel dispenser, satin finish stainless steel, vandal resistant hinged locking cover
3. Mounting: Surface mounted.
4. Owner provided, Contractor installed.

F. Sanitary Napkin Disposal:

1. Basis-of-Design Product: Bobrick; Model B-270
2. Description: Satin-finish stainless steel. Cover is drawn, one-piece construction; secured to cabinet with full-length stainless steel piano-hinge. Capacity: 1.0-gal.
3. Mounting: Surface mounted. .
4. Contractor provided, Contractor installed.

G. Liquid-Soap Dispenser:

1. Basis-of-Design Product: Bobrick; Model 818615
2. Description: Corrosion-resistant valve dispenses commercially marketed all-purpose hand soaps. Container is satin-finish Type 316 stainless steel. Capacity: 40 fl-oz
3. Mounting: Surface mounted.

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4. Owner provided, Contractor installed.
- H. Grab Bar:
1. Basis-of-Design Product: Bobrick; Model B-5806
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel type 304, 0.05 inch thick, smooth, No. 4, satin finish.
 4. Outside Diameter: 1-1/4 inches.
 5. Configuration and Length: As indicated on Drawings.
- I. Mirror Unit (Concession / Restroom Building Only):
1. Basis-of-Design Product: Bobrick; Model B-290 2430
 2. Description: 24" W x 30" H. One-piece, roll-formed 3/4" x 3/4" (19 x 19mm) angle-frame. Type 304 stainless steel angle with satin finish. Corners heliarc welded, ground and polished smooth. Beveled frame edge at mirror for improved appearance. No. 1 quality, 1/4" (6mm) glass mirror; warranted against silver spoilage for 15 years. Galvanized steel back. Secured to concealed wall hanger with theft-resistant mounting.
 3. Contractor provided, Contractor installed.
- J. Mirror Unit (Maintenance Building Only):
1. Basis-of-Design Product: Bobrick; Model B-165 2430
 2. Description: 24" W x 30" H (61 x 76cm). One-piece, 1/2" x 1/2" x 3/8" (13 x 13 x 9.5mm) channel-frame. Type 430 stainless steel with bright-polished finish. Mitered corners. Frame screw permits easy replacement of glass. No. 1 quality, 1/4" (6mm) glass mirror; warranted against silver spoilage for 15 years. Galvanized steel back. Secured to concealed wall hanger with theft-resistant mounting.
 3. Contractor provided, Contractor installed.
- K. Clothes Hook with Bumper:
1. Basis-of-Design Product: Bobrick; Model B-212
 2. Description: Solid aluminum casting, matte finish. Rubber bumper protects wall or partition surfaces.
 3. Mounting: Surface mounted. .
 4. Contractor provided, Contractor installed.
- L. Baby Changing Station
1. Basis-of-Design Product: Koala Corporation – Model KB200-05WG, Color: White Granite.
 2. Description: Baby Changing Station Horizontal Supports static loads up to 400 lbs. Steel-on-Steel hinges with 12 gauge steel mounting supports ADA compliant with proper installation. Child protection straps and diaper bag hook. Molded-in liner dispenser will hold approximately 25 sanitary liners. FDA approved blow-molded high-density polyethylene with Microban Antimicrobial additive (resists odors and bacterial growth). Reinforced full-length steel-on-steel hinge mechanism, with 11-gauge steel mounting plates and mounting hardware included. Molded in graphics and safety messages in six languages and Braille. Contoured changing surface area is 442 sq in (2873 sq mm).
 3. Mounting: Wall mounted
 4. Contractor provided, Contractor installed.

M. Shower Seat

1. Basis-of-Design Product: Bobrick – Model B5181, Color: Opaque White .
2. Description: Reversible Shower Seat – Folding.
3. Seat is constructed of durable, water-resistant, ivory-colored 1/2" (13mm) thick solid phenolic. Reversible for left- or right-hand field installation. Frame and mounting brackets are type 304 stainless steel with self-locking mechanism. Supports up to 360 lbs (163 kg) when properly installed. Seat 33" (840mm) wide, projects 22 5/16" (565mm) from wall. Complies with Planning Guide for Accessible Restrooms
4. **SAFETY WARNING:**
Shower seats are no stronger than the anchors and walls to which they are attached and must be firmly secured in order to support the loads for which they are intended. Consult and comply with local building codes. To avoid potential injury, the building owner or maintenance personnel should remove the shower seat from service if the shower seat is not adequately secured to the wall. In the interests of safety and the protection of end users, this seat should not be used to support weights exceeding 360lbs (163 kg). To avoid potential seat malfunction, DO NOT use seat if weight exceeds 360 lbs (163 kg). Failure to abide by this warning may result in seat malfunctioning, potentially causing minor to moderate injury.
5. Mounting: Wall mounted
6. Contractor provided, Contractor installed.

N. Shower Curtain

1. Basis-of-Design Product: Bobrick – Model 204-2, Color: Opaque White
2. Description: Shower Curtain - 42" W x 72" H (1065 x 1830mm), Opaque, matte white vinyl, .008" (0.2mm) thick, contains antibacterial and flame retardant agents. Nickel-plated brass grommets along top, one every 6" (150mm). Hemmed bottom and sides.
3. Mounting: Wall mounted Requires 7 hooks (not included - see below).
4. Contractor provided, Contractor installed.

O. Shower Hooks

1. Basis-of-Design Product: Bobrick – Model 204-1, Color: Stainless Steel
2. Description: Shower Curtain Hook - Type 304 stainless steel. For use on 1" and 1-1/4" (25 and 32mm) dia. shower curtain rods.
3. Mounting: Provide number required for Shower Curtain listed above
4. Contractor provided, Contractor installed.

P. Shower Rod

1. Basis-of-Design Product: Bobrick – Model 6047 x 36, Color: Stainless Steel.
2. Description: 36" (915mm) length. 1 1/4" (32mm) diameter rod is 18-gauge (1.2mm), type 304 stainless steel, satin finish. 2 1/2" (65mm) flanges are 304 stainless steel, satin finish; Confirm length with shower plan.
3. Mounting: Wall Brackets
4. Contractor provided, Contractor installed.

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SECTION 10 28 00 – TOILET, BATH, AND LAUNDRY ACCESSORIES

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2.4 WARM-AIR DRYERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Excel Dryer Corporation.
- B. High-Velocity Warm-Air Dryer:
 - 1. Basis-of-Design Product: Excel Dryer; Xlerator series; XL-W .
 - 2. Dimensions: 11 3/4" LG by 12 11/16" high by 6 11/16" deep.
 - 3. Weight: 16 lbs.
 - 4. Mounting: Semi-recessed with ADA mounting kit.
 - 5. Operation: Infra-red sensor activated with timed power cut-off switch.
 - 6. Operation Time: under 35 seconds.
 - 7. High-velocity
 - 8. Cover Material and Finish: one-piece, heavy-duty, rib-reinforced, die-cast zinc alloy. To be rust-proof, chip-proofed and tamper/vandal-proof Electrical Requirements: 115 V, 14.4 A, 1653 W.
 - 9. Color: White
 - 10. Contractor provided, Contractor installed.

2.5 UNDERLAVATORY GUARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Basis-of-Design Product: Truebro Lav Guard 2 E-Z
 - 2. Description: Antimicrobial, molded plastic
 - 3. Color: White
 - 4. Mounting: undersink around exposed piping
 - 5. Contractor provided, Contractor installed.

2.6 CUSTODIAL ACCESSORIES

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - a. Bobrick Washroom Equipment, Inc.
 - b. Bradley Corporation.
 - c. American Specialties, Inc.
 - d. A & J Washroom Accessories, Inc.
 - e. General Accessory Manufacturing Co. (GAMCO).

B. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick model B-239.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch thick stainless steel, 34-inch long, 8-inch deep.
 - b. Rod: Approximately 1/4-inch-diameter stainless steel.
6. Contractor provided, Contractor installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

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SECTION 10 44 16 - FIRE EXTINGUISHERS

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. Scope: Provide all labor, materials, equipment and services required to furnish and install the fire extinguishers.
- B. This Section includes Portable Fire Extinguishers, Cabinets and Accessories.

1.3 SUBMITTALS

- A. Prior to installation, submit to the Architect for review the following:
 - 1. Shop Drawings: Show all materials, dimensions, and finishes.
 - 2. Physical Sample: Cabinet finish proposed to be provided.
 - 3. Manufacturer's literature fully describing the product, including installation and maintenance in accordance to section 9062006 IFC and NFPA 10 (latest edition).

1.4 QUALITY ASSURANCE

- A. Provide portable fire extinguishers, cabinets, and accessories by same manufacturer.
- B. Comply with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.5 DELIVERY, HANDLING, AND STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.
- B. Store and protect products in accordance with manufacturer's recommendations.

1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of wall-mounted fire extinguishers with door swings and path of travel concerns.
- C. Final location of wall-mounted fire extinguishers are to be approved by agencies having jurisdiction.

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SECTION 10 44 16 – FIRE EXTINGUISHERS

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PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Types:

1. Kitchen: 2A-40B:C, Type K.
2. All other locations: 4A-60B:C.

2.2 WALL BRACKET

A. Extinguisher manufacturer's standard.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in strict accordance with the Contract Documents and the approved submittals.
- B. Notify the Architect in writing of any irregularities that will adversely affect the proper installation of the cabinet. Commencement of work shall imply acceptance of the wall and opening.
- C. Install square and plumb, and securely anchor mountings brackets to substrate per manufacturer's instructions.
- D. Upon installation employ a certified fire suppression contractor to inspect, certify, tag and date each fire extinguisher.
- E. Remove and replace damaged, defective or undercharged extinguishers.

3.2 INSTALLATION

- A. Install the items of this Section in strict accordance with the original design, approved shoe drawings, and requirements of agencies having jurisdiction, anchoring all components firmly into position

END OF SECTION 10 44 16

SECTION 129300 - SITE FURNISHINGS

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 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

PART 2 - PRODUCTS

- A. As indicated on drawings

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after paving has been completed.

3.3 CLEANING

- A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 12 93 00

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SITE FURNISHINGS – SECTION 12 93 00

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SECTION 131210 - PRE-ENGINEERED PAVILIONS

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. Provide all of the labor, materials, equipment, and services required to furnish and install the pre-engineered pavilions.

1.2 SUMMARY

- A. This Section includes pre-manufactured open pavilion (shelter).

1.3 DESIGN CRITERIA

- A. The primary and secondary framing and covering shall comply, where applicable, with loads and combinations of these loads as set forth in these Specifications, or in the MBMA "Pavilion Systems Manual", whichever is the more stringent.
- B. Must support batting cage netting system as shown in drawings. Coordinate all attachments and connections for full functionality of batting cage usage. Basis of Design for netting system: Beacon Technologies.
- C. The basic design criteria, rationally applied to the structure and its components specified herein shall conform to the applicable form of the following accepted and approved design specifications:
 - 1. Pavilion manufacturer's Association, "Pavilion Systems Manual".
 - 2. American Institute of Steel Construction, "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" and "Code of Standard Practices for Steel Buildings and Bridges".
 - 3. American Iron and Steel Institute, "Specifications for the Design of the Cold-Formed Structural Members".
 - 4. American Society of Testing and Materials, "Book of ASTM Standards, Volume 1 through 11 as applicable.
 - 5. American Welding Society, "Code for ARC and Gas Welding".
- D. In addition to the above, conform to the following:
 - 1. Steel fabricator: Certified by International Accreditation Services (IAS); AC472. The primary frame and the roof installer to have a minimum of 5 years documented experience installing this type of product.

2. Welders, tackers, and welding operators: Qualified in accordance with Code for Welding in Building Construction, AWS D 1.1-83 to perform the type of work required.
3. Structural steel members shall meet requirements of Manual of Steel Construction, Eighth Edition, Part 1 for the types of steel specified.
4. All cold formed steel structural members shall be designed in accordance with the AISI Specification for the Design of Cold Formed Steel Structural Members.
5. Fabrication and Erection: Meet the requirements of AISC Specifications for the Design and Erection of Structural Steel for Buildings, November 1, 1978 and MBMA's "Code of Standard Practice".
6. Welding: In accordance with Requirements of American Welding Society, Structural Welding Code", AWS D1.1-83.

1.4 SUBMITTALS

- A. Prior to installation, submit to the Architect for review the following:
 1. Erection drawings including plans, elevations, cross sections, foundations, and details necessary to erect and finish the pavilion. Drawings shall also include identifying numbers that shall correspond to the actual fabricated and purchased item that shall be physically present on the job site to assemble the pavilion. These drawings shall be submitted and stamped by a registered Engineer in the State where the project is located and provided by the pavilion manufacture.
 2. Indicate:
 - a. Quantity and location of brace angles.
 - b. All flashing conditions and the manner and materials that shall be used.
 - c. Anchor bolt layout.
 - d. Foundation design and loads and reactions and all superimposed and collateral loads.
 3. Provide complete design calculations of ALL slabs, foundation, and structural components.
 - a. Calculations shall bear the stamp of an engineer registered in the State where the project is located.
 4. Physical samples:
 - a. Roof and wall panels for Architect's selection of finish and color.
 - b. Panel profiles, lap, ridge flashing, fasteners, clips and wall panels.
 5. Written specification of pre-qualified welding procedures, prepared by steel fabricator and erector. Prepare these procedures in accordance with Appendix E of the AWS "Structural Welding Code," AWS D1.1-83. Obtain approval before erecting steel.

6. Mill certification that steel supplied meets requirements of the pavilion manufacturer's design specifications.
7. Electrode manufacturer's certification that the electrode and flux combination meets the particular classification or grade of electrodes.
8. Submit certification that the proposed building will be furnished to meet or exceed all design load criteria of the referenced standards and that the structural design will be in strict conformance with that prescribed in MBMA's "Design Practices Manual".
9. Complete and fully descriptive manufacturer's literature which shall include, but not be limited to, the names of materials and components and their proper method of assemblage for this particular project.
10. Submit pavilion shop drawings with wood pile submittal for simultaneous coordination.

1.5 WARRANTY

A. Material and workmanship:

1. Provide 1 year limited warranty against failures caused by faulty or substandard materials.
2. Provide 1 year workmanship guarantee against failures caused by faulty erection.

B. Color coated panels shall be warranted, within limits set by the warranty, for a period of 20 years against chalk, fade, crack, check, blister, or peel.

C. Galvalume panels: Unpainted Galvalume roof panels shall be warranted, within limits set by the warranty, for a period of 20 years against rupture, perforation and structural failure. To apply, panels must be installed using manufacturer approved fasteners.

D. Warranty limits: All warranties shall be subject to certain limits and conditions. Copies of these limits shall be submitted to the Owner and the Architect

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Approved manufacturers subject to compliance with specified requirements:

1. Polygon (Basis of Design).
2. RCP Shelters, Inc..
3. Icon Shelter Systems, Inc.
4. Ultra Shelter.

2.2 CONCRETE FOOTING and FOUNDATION – Provided By the Pre-Engineered Pavilion

Manufacturer.

- A. Manufacturer shall be certified by the governing bodies of the State of manufacture, and the State of destination. Structure shall be constructed according to their regulations, codes and laws.
- B. The shop drawings shall be signed by an engineer/designer licensed in the state of Kentucky and all plans shall bear his/her seal.

2.3 STRUCTURAL FRAMING – Provided By the Pre-Engineered Pavilion Manufacturer.

- A. Primary framing: Main load carrying structural members. Provide transverse rigid frames, lean-to rafters and columns, canopy rafters, interior columns or other types of framing as furnished by the manufacturer. Designed to provide load as indicated in drawings.
 - 1. This framing system system is to provide a clear span, rigid frame designed to support the loads. No field welding to construct the shelter/pavillion.
 - 2. Materials used in the fabrication of primary framing systems: Designed utilizing manufacturer's standard practices in compliance with AISC code latest edition.
 - 3. Structural flat plate, strip and/or bar stock
 - a. Conform to the physical requirements of ASTM A570: Hot-rolled carbon steel sheet and strip of structural quality in cut lengths or coils. This material is intended for structural purposes where mechanical test values are required, and is available in a maximum thickness of 0.229 in. (6.0 mm)
 - b. Shall have a minimum yield strength of 50,000 psi.
 - c. Flanges and webs joined on one side of web by submerged arc continuous weld process.
 - 4. Structural Steel Plates, W, M, and S shapes, angles, rods, channels and other hot rolled shapes.
 - a. Conform to physical requirements of ASTM A36: Carbon structural steel shapes, plates, and bars of structural quality for use in riveted, bolted, or welded construction of buildings, and for general structural purposes
 - b. Shall have minimum yield strengths of 36,000 psi.
 - 5. Round and Tube Steel.
 - a. Conform to physical requirements of ASTM A500 Grade B: cold-formed welded and seamless carbon steel round, square, rectangular, or special shape structural tubing for welded, riveted, or bolted construction of buildings, and for general structural purposes.
 - b. Shall have a minimum yield of 36,000 psi. See drawings for requirements on additional strength/load.
 - c. Shall have minimum wall thickness of 3/16-inches.
 - 6. Connections

- a. Anchor bolts: Conform to the physical requirements of ASTM A307: Carbon steel bolts and studs in specified sizes for three grades (Grades A, B, and C).
 - b. Zinc plated High Strength Bolts and Nuts: Conform to the physical requirements of ASTM A325/A563: Two types of heavy hex structural bolts made of quenched and tempered steel that are intended for use in structural connections. These bolts are designated by type, denoting chemical composition, as follows: Type 1—medium carbon, carbon boron, or medium carbon alloy steel; and Type 3—weathering steel.
 - c. Anchor Rods: Conform to the physical requirements of ASTM F1554 (Grade 36): Anchoring structural supports to concrete foundations such as building columns and column supports.
7. Other yield strength materials: May be used based on particular building design requirements.
- B. Secondary framing: Structural members which distribute the loads to the primary framing systems. Provide eave struts, purlins, girts, wind bracing and other miscellaneous structural members. They shall be manufactured of cold-formed light gauge sections, welded plate sections and/or structural sections.
1. Eave struts: 8" or 10" deep "cee" shaped members. Manufactured of 14 or 12 gauge steel. Design as simple span for indicated loads.
 2. Purlins and girts: Nominal 8", 10" or 12" deep "zee" shaped or "cee" shaped members. Manufacture of 16, 15, 14, or 12 gauge steel designed as simple span, partially continuous or continuous for indicated loads.
 3. Wind bracing: System of diagonal cable bracing, portal, fixed base or diaphragm bracing designed for the specified loads in accordance with manufacturer's design practices. Utilize rods, cables, diaphragm action, angles and/or welded plate or structural members.
 4. Miscellaneous structures: Members to augment the primary, primary endwall and secondary framing systems. Include members such as base angles, flange braces, jambs, headers, and bridging or sag members. Design to be supportive of framing systems.
 5. Materials used in fabrication of secondary framing systems: Design utilizing manufacturer's standard practices, in compliance with AISC and AISI.
 - a. Cold form members: Fabricated of material conforming to physical requirements of ASTM A570 and have minimum yield strength of 55,000 psi.
 - b. Cable bracing: Fabricated of material conforming to physical requirements of ASTM A475-78 for extra high strength grade.
 - c. Rod bracing: Fabricate of material conforming to physical retirements of ASTM A36. Provide minimum yield strength of 36,000 psi.
 - d. Other yield strength materials: Base on particular building design requirements.
 - e. Members fabricated from plate or bar stock: Provide flanges and webs

joined on one side of web by a submerged arc continuous weld process.

2.4 ROOF PANELS:

A. Roof Decking: Select from the following roof decking, provide type as indicated in drawings.

1. T1-11 Plywood as specified in Division 06 Section "Sheathing".
2. T & G Wood
 - a. Size : As indicated in drawing.
 - b. Species: Southern Yellow Pine, kiln dried #1 grade.
 - c. Finish: As selected by Architect from Manufacturer's premium full range.

B. Separation Barrier:

1. 30 pound roofing felt.

C. Roof panels: Standing seam metal roof panel as indicated in drawings, provide attachments, trim and sealants.

1. 24 gauge Galvalume 16 inches wide with ribs 1 ¾ inches high.
2. 26 gauge Galvalume at all trim pieces to include ridge caps, hip caps, eave/fascia trim, splice channels, rake trim, pre-manufactured roof peak cap and corner trim. Refer to drawings for additional information.
3. Sidelaps: Provide one full major rib and utilize bearing edge of underlying major rib for support.
4. Ridge, hip, and valley caps shall be pre-formed with a single central bend to match the roof pitch and shall be hemmed on the sides.
5. Endlaps: 6" and occur over a supporting member.
6. Provide Ridge Caps-continuous
7. Finish: Kynar 500, Architect to select color for Manufacturer full range.

2.5 ADDITIONAL COMPONENTS:

A. Tape Sealants: Preformed butyl rubber base and provided as a 3/32" x 3/8" extruded shape.

B. Tube Sealants: Butyl rubber base caulking material.

C. Closures: Closed cell foam, die cut to panel profiles.

D. Fasteners: "ZAC" Zinc Alloy Cast Head as manufactured by Construction Fasteners, Inc. Fastener manufacturer shall provide 25 year warranty against rust. Fastener shall be compatible with the panel and finish shall match panel.

E. Flashing and/or trim: Provide at eaves, rake, corners, base, framed openings, and wherever necessary to seal against the weather and provide a finished appearance. Color shall be selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. The erection of the pavilions, the foundations and slab installation of accessories shall be performed in accordance with written and drawn instructions and approval of the pavilion manufacturer, the requirements of the Contract Documents and the approved submittals.
- B. Placement of foundations and pavilion is to be by the pavilion manufacture. Erection shall be performed by a qualified erector using proper tools and equipment. It shall be the responsibility of the erector to:
 - 1. Comply with all applicable legal and safety requirements.
 - 2. Determine and provide any and all temporary bracing, bridging, clocking, shoring, and/or securing of components, etc. as required and necessary for stability during the entire erection process.
- C. In addition, erection practices shall conform to Section 5, MBMA "Code of Standard Practices." There shall be no field modifications to primary structural members except as authorized (in writing) manufacturer and approved (in writing) by the Architect.

3.2 PAVILION ANCHORAGE AND FOUNDATIONS:

- A. The pavilion anchor bolts shall be designed to resist the maximum column reactions resulting from the specified combinations of loadings (bolt steel shall be 36,000 psi) or as recommended by the pavilion manufacture.
- B. The design of anchor bolts, footing, attachment to wood piles and footing reinforcement:
 - 1. Responsibility of the pavilion manufacturer.
 - 2. Shall be stamped and approved by an engineer licensed in the state in which the building will be constructed and provided by the pavilion manufacture.

END OF SECTION 131210

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SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

1 PART 1 GENERAL

1.1 WORK INCLUDED

- A. All labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- B. Principal features of work included are:
 - 1. Plumbing system and related piping insulation.
 - 2. Excavating and backfilling for plumbing work.
 - 3. Furnish anchor bolts, sleeves, and similar items to be built into concrete and masonry.
 - 4. Preparation and submittal of maintenance manuals, shop drawings, and product data.
 - 5. Electrical interlock and control or low voltage wiring.

1.2 INTENT

- A. The contract documents (drawings, plans and specifications) describe the plumbing work of this project.
- B. Any item mentioned in one part shall be as binding as though mentioned in both.
- C. The contract documents form a guide for a complete plumbing installation.
- D. Provide any item that is reasonably necessary but not specifically mentioned, such as duct hangers or transitions, piping offsets, drains, etc., for a complete system.
- E. Plumbing layouts indicated on drawings are diagrammatic only.
- F. Exact locations of pipes equipment shall be governed by the drawings of related trades.
- G. Owner or his representative reserves right to make reasonable changes in location of plumbing equipment and appurtenances.

1.3 QUALITY ASSURANCE

- A. Comply with applicable local, state, and federal codes.
- B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades.
- C. Employ only qualified journeymen for this work.
- D. Supervise all work by competent plumber specifically qualified in his discipline.

1.4 FEES AND PERMITS

- A. Coordinate with General Contractor to secure and pay for permits, licenses, and inspections required for work under this division, including water and sewage tap.
- B. Owner shall bear the cost of local city sewer capacity charge.
- C. Give notices and comply with all laws, ordinances, rules and regulations applicable to work.

1.5 CODES AND STANDARDS

- A. Plumbing installation to be in accordance with applicable local, state, and federal codes having jurisdiction. Codes considered applicable to project shall include but not be limited to:
 - 1. NFPA 90A: Air Conditioning and Ventilation Systems.
 - 2. NFPA 101: Life Safety Code.
 - 3. IBC: International Building Code, with Mechanical & Plumbing Codes.
 - 4. ANSI Handicapped Code A117.1.

5. ANSI: American National Standards Institute.
6. ASME: American Society of Mechanical Engineers.
7. ASTM: American Society for Testing and Materials.
8. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
9. NEMA: National Electrical Manufacturers' Association.
10. NFPA: National Fire Protection Association.
11. UL: Underwriters' Laboratories, Inc.

B. Work shall be installed in strict conformity with applicable codes.

C. Submit and/or file with proper authorities necessary contract documents as required by governing authorities.

1.6 COORDINATION

A. Visit site and be informed of conditions under which work must be performed.

B. Carefully examine drawings and specifications to be thoroughly familiar with items which require plumbing connections and coordination.

C. Notify other tradesmen of any deviations or special conditions necessary for installation of work.

D. Resolve interferences between work of various contractors prior to installation.

E. Advise masonry contractor to leave proper chases and openings. Place outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

1.7 SUBMITTALS

A. Submit for approval electronic copies of complete brochures and shop drawings of materials, fixtures, and equipment, proposed, giving names of manufacturers, trade name, and specific catalog numbers.

B. Brochures:

1. Submit complete descriptions, illustrations, specification data, etc., of materials, and equipment proposed.
2. Clearly indicate proposed items when other items are shown on same sheet.
3. Submittals shall bear Contractor's stamp of approval evidencing he has examined and checked same and information contained therein is in accordance with contract requirements, and any deviations shall be clearly marked.

1.8 OPERATING AND MAINTENANCE MANUALS:

A. Prior to final acceptance of project, furnish to Owner three bound manuals of instructions for operation and maintenance of equipment and systems furnished under this division; binder to be 3-ring, hard-cover type.

B. As a minimum the following data are required:

1. Operating and maintenance instructions.
2. Spare parts list.
3. Copies of approved submittal data.
4. Equipment warranties.

C. Clearly indicate items furnished on this project.

D. Supervise initial operation of systems and equipment and verbally instruct Owner in such operation in addition to manuals mentioned above.

1.9 PROTECTION OF MATERIALS:

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging.
- B. Other materials and equipment to be covered or otherwise protected against damage from water, dirt, chemical, or mechanical injury. This includes during on-site storage, after installation and until final acceptance.
- C. Store items in a clean, dry place and protect from damage.
- D. Damaged painted surfaces of equipment to be touched up to match original paint.

1.10 RECORD DRAWINGS

- A. Keep a record set of blueline prints at jobsite exclusively for recording deviations from the drawings which are necessary because of job conditions.
- B. Mark deviations in colored pencils for ease of identification of various systems.
- C. When work is complete record all changes onto sepia drawings. One set of reproducible sepias will be made and given to the owner (s) for their "Record Drawings" set.

2 PART -2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment:
 - 1. Bear the UL labels when available.
- B. Specifications and drawings indicate name, type, or catalog numbers of materials and equipment to be used as "Standards".
- C. Base proposals on "Standards" specified. Do not construe "Standards" as limiting competition. Manufacturers not specified may be used with Engineers approval.

3 PART -3 EXECUTION

3.1 LOCATIONS

- A. Plumbing layouts indicated on drawings are diagrammatic.
- B. Exact locations of pipes and equipment may vary because of conflicts with work of other trades.
- C. Work out conflicts where relocations will not affect operation or appearance of systems.
- D. Locate equipment requiring periodic servicing or adjustment so that it is readily accessible.
- E. Do not backup service sides to walls or place it too close to other equipment to make service impractical.
- F. Do not locate traps, controls, unions, pull boxes, etc., in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in piping systems.

3.2 CUTTING AND PATCHING

- A. All openings in drywall, concrete, block, floor and roof decks to be sized and located by plumbing but cut and patched by appropriate trade providing that structure.

3.3 DAMAGE REPAIR

- A. Correct unnecessary damage caused due to installation of plumbing work.
- B. Perform repairs with materials which match existing.

3.4 COUNTERFLASHING

A. Counterflash pipes, where penetration of roofs and outside walls occur.

3.5 UTILITIES EXCAVATING AND BACKFILLING

A. Provide trenching, excavation, and backfilling necessary for installation of plumbing work.

B. Depth of excavation to provide a minimum of 36" above top of pipe.

C. Excavation to be carried to a depth at least 6" below bottom of pipe elevation.

D. Fill below pipe (6"), around pipe, and minimum of 12" above pipe with sand or Class 'B' crushed stone tamped firm and even.

3.6 ACCEPTANCE OF SYSTEMS

A. Complete the following before requesting a final inspection:

1. All work required under this division of the specifications except as permitted.
2. System balancing.
3. Control system checkout.

3.7 WARRANTY AND SERVICE

A. Contractor shall and hereby does guarantee that all work installed under this Division shall be free from defects in workmanship and materials for a period of one year from date of substantial usage, from date of occupancy of project, or from date of final acceptance, whichever is earliest.

B. Above parties further agree they will repair and replace defective material or workmanship which becomes defective within terms of this warranty-guarantee.

C. Upon final acceptance of work, Owner will assume responsibility of supervision, operating, and maintaining equipment.

D. Owner will lubricate motors and other operating components, clean strainers, make minor adjustments for proper operating conditions, and report defective materials or workmanship to Contractor.

E. Owner will make emergency repairs only if Contractor is unavailable, and such repairs will in no case void a warranty or guarantee.

F. Upon expiration of each of these limits noted herein, maintenance including labor and materials costs will be at Owner's expense.

END OF SECTION 220500

SECTION 220510: PLUMBING SUPPORTS AND ANCHORS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and equipment hangers and supports.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing and sealing equipment and pipe stacks.

1.2 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.2 - Fuel Gas Piping
- C. ASME B31.9 - Building Services Piping
- D. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- E. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- F. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- G. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- H. NFPA 14 - Installation of Standpipe and Hose Systems

2 PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Grinnel(basis of design), Tolco, or an approved equal.
- B. Plumbing Piping - DWV:
 - 1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
 - 2. Hangers for Pipe Sizes 1/2 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 Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
 - 1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 - 7. Vertical Support: Steel riser clamp.
 - 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb/sq ft sheet lead
2. Soundproofing: 1 lb/sq ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Firestopping Insulation: Glass fiber type, non-combustible.

E. Sealant: Acrylic.

3 PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- B. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- C. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counterflash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor & mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
- F. Adjust storm collars tight to pipe with bolts; calk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1 inch above finished floor level. Calk sleeves.
- D. Where piping penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and calk air tight.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

PIPE SIZE	HANGER ROD MAX. HANGER SPACING	DIAMETER
Inches	Feet	Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8
PVC (All Sizes)	6	3/8

END OF SECTION 220510

SECTION 220700: PLUMBING INSULATION

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 REFERENCES

- A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- D. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
- E. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- F. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- G. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- H. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
- I. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
- J. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- K. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- L. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
- M. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- N. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- P. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- Q. NAIMA National Insulation Standards.
- R. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- S. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Knauf
- B. Owens Corning

- C. Manville
- D. Or an approved equal.

2.2 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. 'K' value: ASTM C177, 0.23 at 75 degrees F .
 - 2. Maximum service temperature: 850 degrees F .
 - 3. Maximum moisture absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket:
 - 1. ASTM C921, White kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Vapor Barrier Lap Adhesive:
 - 1. Compatible with insulation.
- E. Insulating Cement/Mastic:
 - 1. ASTM C195; hydraulic setting on mineral wool.

2.3 JACKETS

- A. Canvas Jacket: UL listed.
 - 1. Fabric: ASTM C921, 6 oz/sq yd , plain weave cotton treated with dilute fire retardant lagging adhesive.
 - 2. Lagging Adhesive:
 - a. Compatible with insulation.

3 PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Inserts and Shields:
1. Application: Piping 2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 SCHEDULES

- A. Plumbing Systems:
1. Domestic Cold Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1/2 inch .
 2. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch .
- B. Cooling Systems:
1. Refrigerant Suction:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch .

END OF SECTION 220700

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SECTION 221116 – DOMESTIC WATER, WASTE, AND VENT PIPING

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Sanitary sewer & vent.
 - 2. Domestic water.

1.2 REFERENCES

- A. AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- B. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- C. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B16.22 - Wrought Copper and Bronze Solder Joint Pressure Fittings.
- F. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- H. ASME B31.1 - Power Piping.
- I. ASME B31.9 - Building Service Piping.
- J. ASME SEC IX - Welding and Brazing Qualifications.
- K. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- L. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- M. ASTM B32 - Solder Metal.
- N. ASTM B42 - Seamless Copper Pipe.
- O. ASTM B43 - Seamless Red Brass Pipe.
- P. ASTM B88 - Seamless Copper Water Tube (ASTM B88M - Seamless Copper Water Tube).
- Q. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube (ASTM B251M - Wrought Seamless Copper and Copper-Alloy Tube).
- R. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- S. ASTM B302 - Threadless Copper Pipe (TP).
- T. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- U. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- V. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- W. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- X. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- Y. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- Z. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- AA. ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- BB. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

- CC. AWS A5.8 - Brazing Filler Metal.
- DD. AWWA C651 - Disinfecting Water Mains.
- EE. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- FF. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- GG. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- HH. MSS SP-67 - Butterfly Valves.
- II. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- JJ. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
- KK. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
- LL. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- MM. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- NN. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- OO. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- PP. NCPWB - Procedure Specifications for Pipe Welding.
- QQ. NFPA 54 - National Fuel Gas Code.
- RR. UL 1479 - Fire Tests of Through-Penetration Firestops.

2 PART 2 PRODUCTS

2.1 SANITARY SEWER & VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER & VENT PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B42, Type K or L.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, solder, Grade 95TA.

2.4 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type K or L.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, solder, Grade 95TA.

2.5 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 3 inches and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Pipe Size Over 1 inch :

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Grooved and Shouldered Pipe End Couplings:
1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 2. Sealing gasket: "C" shape composition sealing gasket.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.6 PIPE HANGERS AND SUPPORTS

- A. See Section 220510.

2.7 VALVE MANUFACTURERS

- A. Nibco
- B. Watts
- C. Or an approved equal.

2.8 GATE VALVES

- A. Up To and Including 1-1/2 inches:
1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.
- B. 2 inches and Larger:
1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.9 BALL VALVES

- A. Construction, 4 inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder ends with union.

2.10 WATER PRESSURE REDUCING VALVES

- A. Up to 2 inches :
1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, and single union ends.
- B. Over 2 inches :
1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.11 RELIEF VALVES

- A. Pressure Relief:
1. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
1. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F , capacity ASME SEC IV certified and labelled.

2.12 STRAINERS

2.13 STRAINER MANUFACTURERS

A. Strainer Manufacturers

1. Nibco
2. Watts
3. Or an approved equal.

B. Size 1-1/2 inch to 4 inch :

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

3 PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

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. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Establish elevations of buried piping outside the building to ensure not less than 3.5 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

Q. Install water piping to ASME B31.9.

R. Sleeve pipes passing through partitions, walls and floors.

S. Inserts:

1. See Section 220510.

T. Pipe Hangers and Supports:

1. See Section 220510.

3.4 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install ball valves for throttling, bypass, or manual flow control services.
- F. Provide flow controls in water recirculating systems where indicated.

3.5 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer .
 1. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

END OF SECTION 221116

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SECTION 221119 – DOMESTIC WATER AND WASTE PIPING SPECIALTIES

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cleanouts.
- B. Backflow preventers.
- C. Water hammer arrestors.

1.2 NCES

- A. ASME A112.26.1 - Water Hammer Arrestors.
- B. ASSE 1011 - Hose Connection Vacuum Breakers.
- C. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- D. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- E. PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- F. PDI WH-201 - Water Hammer Arrestors.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Ancon
- B. J.R. Smith
- C. Zurn
- D. Or an approved equal.

2.2 CLEANOUTS

- A. Exterior Surfaced Areas:
 - 1. Round cast nickel bronze access frame and non-skid cover.
- B. Exterior Unsurfaced Areas:
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- C. Interior Finished Floor Areas:
 - 1. Galvanized cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and roundgasketed depressed cover to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas:
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- E. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.3 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers:
 - 1. Manufacturers:
 - a. Watts, Wilkens, or equal.

2. AWWA C506; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.4 WATER HAMMER ARRESTORS

- A. ANSI A112.26.1; stainless steel construction, piston type sized in accordance with PDI WH-201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 250 psi working pressure.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Pipe relief from backflow preventer to nearest drain.
- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, & washing machine outlets.
- G. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION 221119

SECTION 22 13 13 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Excavation and backfill for sanitary system.
- B. Installation of manholes, junction boxes, lift stations, and the like.
- C. Repair and/or raising of existing manholes or other structures.
- D. Installation and testing of sanitary sewers.

1.2 QUALITY ASSURANCE

- A. All work is to conform to applicable local and/or state plumbing codes and the utilities involved.

1.3 MEASURE AND PAYMENT

- A. No separate payment shall be made for material or work under this section. All costs shall be included in the bid items to which the work pertains.

1.4 WARRANTIES/GUARANTEEE

- A. For a period of one year from the date of issuance of the Final Certificate for Payment for the work, the Contractor shall furnish and install, without cost to the Owner, any and all work which, in the judgment of the Owner, proves defective in materials and/or workmanship.

PART 2 - PRODUCTS

2.1 STANDARDS

- A. Where ASTM or AASHTO standards are referred to these are made a part of this section, unless otherwise noted. Such standards shall be current issues and amendments.

2.2 MATERIALS

- A. Sanitary Sewer Products: All sanitary sewer piping and products shall conform to requirements of the Sewer Department with local jurisdiction. If items are in conflict with other items as indicated in this section, requirements of the Sewer Department with local jurisdiction take precedent.

2.3 MIXES

- A. Concrete (below ground where detailed); 3000 psi, Class A, air-entrained as per GDOT.
- B. Concrete (Surface or other where detailed); 3500 psi, Class A air-entrained as per GDOT.
- C. Mortar: Mortar shall comply with ASTM Standard Specification for Mortar for Unit Masonry, average compressive strength at 28 day, 1800 psi. Mortar mix shall be:
 - 1. 1 part Portland cement

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2. 1 part hydrated lime
 3. 6 parts sand measured by volume
- D. Parging: Parging shall consist of two parts fine sand and one part Portland cement measured by volume.

PART 3 - EXECUTION

3.1 FIELD CONSTRUCTED MANHOLES AND VAULTS

- A. General: All manholes and vaults shall be constructed where shown on the drawings. Unless otherwise indicated on the drawings, the minimum inside diameter for all circular manholes shall be 4'-0" and the minimum interior side dimensions of square or rectangular manholes shall be 4'-0"
- B. Unless the elevations of tops of manholes are indicated on drawings, or are set in pavement or floor slabs, all manholes shall be brought above grade a sufficient distance to prevent surface or ground water from entering the manhole.
- C. The inside of all manholes shall be equipped with cast iron steps 12" wide, with ends solidly embedded in the masonry or concrete walls. Steps shall be at least 8 inches away from the wall and spaced 12 inches apart.
- D. The bottom of sanitary manholes shall be sloped so as to drain to the sewers. Invert channels shall be smooth, accurately shaped, and in accordance with details shown on drawings. Invert channels in manholes serving sanitary or combination storm and sanitary systems shall be constructed using half-tile earthenware pipe sections in the concrete base.

3.2 REINFORCED CONCRETE MANHOLES AND VAULTS

- A. Reinforced concrete manholes and vaults shall be constructed in accordance with the drawings using concrete having a minimum ultimate 28-day compressive strength of 3,500 pounds per square inch as well as conforming to requirements listed above under mixes.

3.3 PARGING

- A. The inside and outside walls of brick manholes, and vaults shall be parged with a coat of cement plaster 1/2 inch thick, troweled smooth, beveled at the top and coved out at the edge of the footing.

3.4 PRECAST CONCRETE MANHOLES AND VAULTS

- A. Furnish and install precast concrete manholes as indicated on the drawings. Unless otherwise indicated on the drawings, the minimum inside diameter of all manholes shall be 4'-0".
- B. The bottom riser pipe for sanitary manholes shall be furnished with cut outs for the sewer and shall be founded on concrete cast in place slab. Slab shall be minimum 8" thick and reinforced; concrete shall have a minimum ultimate 28-day compressive strength of 4,000 pounds per square inch.
- C. After the bottom riser of a sanitary manhole is set in place, the bottom of the manhole shall be sloped to drain to the sewer with cast in place concrete. Invert channels shall be constructed by laying half tile pipe sections in concrete base or by laying the full section of sewer pipe straight through the manhole and cutting out the top half, after the concrete in the base has attained its final set.

- D. All manholes shall be furnished with eccentric cone top. (Note: a flat slab top may be used only when minimum cover will be available, and its use is approved by the Owner's Representative.) The riser sections shall be made up of suitable lengths (minimum 1'-0" increments) sectioned so that the top of the cone section shall terminate not less than 2'-0" below the intended finished grade. The remaining section, above the riser top to the manhole frame base, shall be constructed of brick.
- E. The cast iron cover or frame shall be either grouted to the top of the brick wall, or the underside of the cover or frame shall be caulked with hot asphalt cement.
- F. All manholes shall be equipped with cast iron steps, cast into the riser walls. Steps shall be aligned in each section to form a continuous ladder with rungs equally spaced vertically in the assembled manhole at a design distance apart of 12", consistent with local safety codes.
- G. Joints between manhole units shall be either coupled with rubber gaskets or filled with Portland cement mortar.

3.5 PIPE

A. General

- 1. All sewers, drains, and connections constructed, reconstructed, or repaired as herein specified or indicated on drawings, shall be built to lines and grades shown on drawings.
- 2. Installation of sanitary sewer shall be laid in properly prepared trenches in accordance with Standard Recommended Practice of local utility department with review authority.
- 3. Reference points and stakes shall be established and provided by the Contractor for the work under this Section, and he shall be fully liable for their accuracy.
- 4. Pipe shall be protected during handling against impact shocks and free fall.

B. Bedding

- 1. Trenches shall be dry when the trench bottom is prepared. A continuous trough shall be prepared or excavated to receive the bottom quadrant of the pipe barrel. Excavate bell holes so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.
- 2. Bedding for pipe shall be as specified in the drawings and in conformance with applicable provisions of Standard Recommended Practice of local utility department with review authority.
- 3. Preparation of the trench bottom and placement of the pipe shall be carefully made so that when in final position, the pipe is true to line and grade (see "Excavation").

C. Laying

- 1. Commence laying of sewer pipe at lowest point with spigot ends pointing in direction of flow.
- 2. All pipes shall be laid using grade bar, cord line, pole and plumb or laser beam for determining a fixed or constant grade.
- 3. Pipe shall be cleaned inside before laying and terminations left exposed shall be tightly plugged until work is resumed.
- 4. Lay all pipe with ends abutting and true to line and grade and carefully centered, so that when laid they will form a sewer with a uniform invert.
- 5. All pipes shall be laid on a straight line. Pipe shall slope from the inlet and continuously, as specified, to the public main sewer, or other specified point of discharge.
- 6. Lay pipe accurately to the line and grade as designated. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material

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shall be clean and dry. Use lubricants, primers, adhesives, etc., as recommend by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall be placed, fitted, jointed, and adjusted in a workmanlike manner.

7. Keep trenches water-free and as dry as possible during bedding, laying and jointing and for a long period as required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe offline and grade.

D. Testing

1. Flush sewers to obtain a free flow of clear water through all lines. Test installation section by section, unless otherwise directed. Remove all obstructions and correct all defects discovered.

3.6 Clean-Outs

- A. Install clean-outs in the locations as shown on the plan and in accordance with the details.

3.7 BACKFILLING See Section 310000.

3.8 REPAIR

- A. Unless otherwise specified or noted, all cutting of pavements, concrete floors, streets, walks, etc., - necessary for excavating - shall be include under this section, as shall be replaced or repaired to their original condition or better and to the entire satisfaction of the Owner's Representative and authorities having jurisdiction.

3.9 CLEAN-UP

- A. Unless otherwise specified or directed, all curbs, crosswalks, sidewalk material, rocks, or other unusable surface material shall be removed from the premises.
- B. Surplus earth excavation shall be placed in the site where directed by the Owner's Representative and spread in 6" layers or hauled away from the site. Unless specific arrangements are made, the earth shall remain the property of the Owner.

END OF SECTION 22 13 13

SECTION 224000: PLUMBING FIXTURES

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Showers
- F. Service sinks.

1.2 REFERENCES

- A. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- B. ASME A112.19.1 - Enamelled Cast Iron Plumbing Fixtures.
- C. ASME A112.19.2 - Vitreous China Plumbing Fixtures.
- D. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- E. ASME A112.19.4 - Porcelain Enamelled Formed Steel Plumbing Fixtures.
- F. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.

2 PART 2 PRODUCTS

2.1 PLUMBING FIXTURES

- A. Manufacturers:
 - 1. American Standard, Symmons, Sloan Regal, JR Smith, Stern Williams, Halsey Taylor: (basis of design).
 - 2. Eljer, Elkay, Kohler, Oasis, Sunroc, Zurn, or an approved equal.

3 PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.

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- D. Install and secure fixtures in place with wall carriers and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.
- F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

END OF SECTION 224000

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

1 PART 1 GENERAL

1.1 WORK INCLUDED

- A. All labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- B. Principal features of work included are:
 - 1. Heating, ventilating, air-conditioning systems, controls and mechanical systems insulation.
 - 2. Roof curbs for intake hoods, relief hoods, and exhaust fans furnished and set by mechanical contractor.
 - 3. Excavating and backfilling for mechanical work.
 - 4. Furnish anchor bolts, sleeves, and similar items to be built into concrete and masonry.
 - 5. Preparation and submittal of maintenance manuals, shop drawings, and product data.
 - 6. Electrical interlock and control or low voltage wiring.

1.2 INTENT

- A. The contract documents (drawings, plans and specifications) describe the mechanical work of this project.
- B. Any item mentioned in one part shall be as binding as though mentioned in both.
- C. The contract documents form a guide for a complete mechanical installation.
- D. Provide any item that is reasonably necessary but not specifically mentioned, such as duct hangers or transitions, piping offsets, drains, etc., for a complete system.
- E. Mechanical layouts indicated on drawings are diagrammatic only.
- F. Exact locations of ducts and equipment shall be governed by the drawings of related trades.
- G. Owner or his representative reserves right to make reasonable changes in location of mechanical equipment and appurtenances.

1.3 QUALITY ASSURANCE

- A. Comply with applicable local, state, and federal codes.
- B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades.
- C. Employ only qualified journeymen for this work.
- D. Supervise all work by competent mechanic specifically qualified in his discipline.

1.4 FEES AND PERMITS

- A. Coordinate with General Contractor to secure and pay for permits, licenses, and inspections required for work under this division, including water and sewage tap.
- B. Give notices and comply with all laws, ordinances, rules and regulations applicable to work.

1.5 CODES AND STANDARDS

- A. Mechanical installation to be in accordance with applicable local, state, and federal codes having jurisdiction. Codes considered applicable to project shall include but not be limited to:
 - 1. NFPA 90A: Air Conditioning and Ventilation Systems.
 - 2. NFPA 101: Life Safety Code.
 - 3. IBC: International Building Code, with Mechanical & Plumbing Codes.
 - 4. ANSI Handicapped Code A117.1.
 - 5. AMCA: Air Moving and Conditioning Associations, Inc.

6. ANSI: American National Standards Institute.
7. ARI: American Refrigeration Institute.
8. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers.
9. ASME: American Society of Mechanical Engineers.
10. ASTM: American Society for Testing and Materials.
11. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
12. NEMA: National Electrical Manufacturers' Association.
13. NFPA: National Fire Protection Association.
14. SMACNA: Sheet Metal Construction for Ventilating, and Air Conditioning Systems.
15. UL: Underwriters' Laboratories, Inc.

B. Work shall be installed in strict conformity with applicable codes.

C. Submit and/or file with proper authorities necessary contract documents as required by governing authorities.

1.6 COORDINATION

A. Visit site and be informed of conditions under which work must be performed.

B. Carefully examine drawings and specifications to be thoroughly familiar with items which require HVAC connections and coordination.

C. Notify other tradesmen of any deviations or special conditions necessary for installation of work.

D. Resolve interferences between work of various contractors prior to installation.

E. Advise masonry contractor to leave proper chases and openings. Place outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

1.7 SUBMITTALS

A. Submit for approval electronic copies of complete brochures and shop drawings of materials, fixtures, and equipment, proposed, giving names of manufacturers, trade name, and specific catalog numbers.

B. Brochures:

1. Submit complete descriptions, illustrations, specification data, etc., of materials, and equipment proposed.
2. Clearly indicate proposed items when other items are shown on same sheet.
3. Submittals shall bear Contractor's stamp of approval evidencing he has examined and checked same and information contained therein is in accordance with contract requirements, and any deviations shall be clearly marked.

1.8 OPERATING AND MAINTENANCE MANUALS:

A. Prior to final acceptance of project, furnish to Owner three bound manuals of instructions for operation and maintenance of equipment and systems furnished under this division; binder to be 3-ring, hard-cover type.

B. As a minimum the following data are required:

1. Operating and maintenance instructions.
2. Spare parts list.
3. Copies of approved submittal data.
4. Equipment warranties.

C. Clearly indicate items furnished on this project.

D. Supervise initial operation of systems and equipment and verbally instruct Owner in such operation in addition to manuals mentioned above.

1.9 PROTECTION OF MATERIALS:

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging.
- B. Other materials and equipment to be covered or otherwise protected against damage from water, dirt, chemical, or mechanical injury. This includes during on-site storage, after installation and until final acceptance.
- C. Store items in a clean, dry place and protect from damage.
- D. Damaged painted surfaces of equipment to be touched up to match original paint.

1.10 RECORD DRAWINGS

- A. Keep a record set of blueline prints at jobsite exclusively for recording deviations from the drawings which are necessary because of job conditions.
- B. Mark deviations in colored pencils for ease of identification of various systems.
- C. When work is complete record all changes onto sepia drawings. One set of reproducible sepias will be made and given to the owner (s) for their "Record Drawings" set.
- D. Refer to Division 1 for any additional requirements of record drawings.

2 PART -2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment:
 - 1. Bear the UL labels when available.
- B. Specifications and drawings indicate name, type, or catalog numbers of materials and equipment to be used as "Standards".
- C. Base proposals on "Standards" specified. Do not construe "Standards" as limiting competition. Manufacturers not specified may be used with Engineers approval.

3 PART -3 EXECUTION

3.1 LOCATIONS

- A. Mechanical layouts indicated on drawings are diagrammatic.
- B. Exact locations of ductwork and equipment may vary because of conflicts with work of other trades.
- C. Work out conflicts where relocations will not affect operation or appearance of systems.
- D. Locate equipment requiring periodic servicing or adjustment so that it is readily accessible.
- E. Do not backup service sides to walls or place it too close to other equipment to make service impractical.
- F. Do not locate traps, controls, unions, pull boxes, etc., in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in duct, electrical and piping systems.

3.2 CUTTING AND PATCHING

- A. All openings in drywall, concrete, block, floor and roof decks to be sized and located by mechanical but cut and patched by appropriate trade providing that structure.

3.3 DAMAGE REPAIR

- A. Correct unnecessary damage caused due to installation of mechanical work.
- B. Perform repairs with materials which match existing.

3.4 COUNTERFLASHING

- A. Counterflash ducts where penetration of roofs and outside walls occur.

3.5 UTILITIES EXCAVATING AND BACKFILLING

- A. Provide trenching, excavation, and backfilling necessary for installation of mechanical work.
- B. Depth of excavation to provide a minimum of 36" above top of pipe.
- C. Excavation to be carried to a depth at least 6" below bottom of pipe elevation.
- D. Fill below pipe (6"), around pipe, and minimum of 12" above pipe with sand or Class 'B' crushed stone tamped firm and even.

3.6 ACCEPTANCE OF SYSTEMS

- A. Complete the following before requesting a final inspection:
 - 1. All work required under this division of the specifications except as permitted.
 - 2. System balancing.
 - 3. Control system checkout.

3.7 WARRANTY AND SERVICE

- A. Contractor shall and hereby does guarantee that all work installed under this Division shall be free from defects in workmanship and materials for a period of one year from date of substantial usage, from date of occupancy of project, or from date of final acceptance, whichever is earliest.
- B. Above parties further agree they will repair and replace defective material or workmanship which becomes defective within terms of this warranty-guarantee.
- C. Upon final acceptance of work, Owner will assume responsibility of supervision, operating, and maintaining equipment.
- D. Owner will lubricate motors and other operating components, clean strainers, make minor adjustments for proper operating conditions, and report defective materials or workmanship to Contractor.
- E. Owner will make emergency repairs only if Contractor is unavailable, and such repairs will in no case void a warranty or guarantee.
- F. Upon expiration of each of these limits noted herein, maintenance including labor and materials costs will be at Owner's expense.

END OF SECTION 230500

SECTION 230510 - HVAC SUPPORTS AND ANCHORS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and equipment hangers and supports.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing and sealing equipment and pipe stacks.

1.2 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.5 - Refrigeration Piping
- C. ASME B31.9 - Building Services Piping
- D. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- E. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- F. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- G. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- H. NFPA 14 - Installation of Standpipe and Hose Systems
- I. UL 203 - Pipe Hanger Equipment for Fire Protection Service

2 PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Grinnel(basis of design), Tolco, Or an approved equal.
- B. Refrigerant Piping:
 - 1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69, & MSS SP89.
 - 2. Hangers for Pipe Sizes 1/2 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. Vertical Support: Steel riser clamp.
 - 7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.

- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
 - 1. Waterproofing: 5 lb/sq ft sheet lead
 - 2. Soundproofing: 1 lb/sq ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

- A. Manufacturers:
 - 1. Thy-Curb
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. RSI(Roof Systems Inc.)
- B. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, factory installed wood nailer.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- F. Firestopping Insulation: Glass fiber type, non-combustible.
- G. Sealant: Acrylic.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.

- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- B. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- C. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
- C. Provide curbs for mechanical roof installations 24 inches minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

3.6 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1 inch above finished floor level. Calk sleeves.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and calk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

PIPE SIZE	HANGER ROD	
	MAX. HANGER SPACING	DIAMETER
Inches	Feet	Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2

END OF SECTION 230510

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SECTION 230593: TESTING, ADJUSTING, AND BALANCING

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of refrigerating systems.

1.2 REFERENCES

- A. AABC - National Standards for Total System Balance.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.3 SUBMITTALS

- A. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- B. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- C. Test Reports: Indicate data on AABC National Standards for Total System Balance forms.

1.4 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance & NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.5 QUALIFICATIONS

- A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

2 PART 2 EXECUTION

2.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.

- 10. Air outlets are installed and connected.
- 11. Duct system leakage is minimized.
- 12. Proper strainer baskets are clean and in place.
- 13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

2.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

2.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

2.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

2.5 AIR SYSTEM PROCEDURE

A. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

B. Measure air quantities at air inlets and outlets.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

D. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

2.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing

Air Cooled Condensing Units
Air Handling Units
Air Filters
Air Inlets and Outlets

B. Report Forms

1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone number of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
3. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
4. Air Cooled Condenser:
 - a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Number of compressors
5. Cooling Coil Data:
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Entering air DB temperature, design and actual
 - g. Entering air WB temperature, design and actual
 - h. Leaving air DB temperature, design and actual
 - i. Leaving air WB temperature, design and actual
 - j. Saturated suction temperature, design and actual
 - k. Air pressure drop, design and actual
6. Heating Coil Data:
 - a. Identification/number
 - b. Location

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- c. Service
- d. Manufacturer
- e. Air flow, design and actual
- f. Entering air temperature, design and actual
- g. Leaving air temperature, design and actual
- h. Air pressure drop, design and actual
- 7. Air Moving Equipment
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
- 8. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
- 9. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow

END OF SECTION 230593

SECTION 230700: DUCTWORK INSULATION

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Ductwork insulation.
- B. Insulation jackets.

1.2 REFERENCES

- A. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- E. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- H. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- J. NAIMA National Insulation Standards.
- K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- L. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Knauf, Owens Corning, Manville, Or an approved equal.

2.2 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value : ASTM C518, 0.29 at 75 degrees F .
 - 2. Maximum service temperature: 250 degrees F .
 - 3. Maximum moisture absorption: 0.50 percent by volume.
- B. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
 - 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

- D. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- E. Tie Wire: Annealed steel, 16 gage .

2.3 JACKETS

- A. Aluminum Jacket: ASTM B209 .
 - 1. Thickness: 0.020 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

3 PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms, Cart Storage areas, or Finished Spaces: Finish with aluminum jacket.
- E. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.3 SCHEDULES

- A. Supply, Return, & Outside Air Ducts:
 - a. Glass Fiber Insulation:
 - 1) Duct Size Range: All sizes.
 - 2) Thickness: 1-1/2 inch .

END OF SECTION 230700

SECTION 233100 – HVAC DUCTS AND CASINGS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Duct cleaning.

1.2 RELATED SECTIONS

- A. Section 230510 - HVAC Supports and Anchors: Sleeves.
- B. Section 230700 - Ductwork Insulation.
- C. Section 233300 - Air Duct Accessories.
- D. Section 233700 - Diffusers, Registers, and Grilles.
- E. Section 230593 - Testing, Adjusting and Balancing.

1.3 REFERENCES

- A. ASTM A 36 - Structural Steel.
- B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- F. ASTM A 525 - General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process.
- G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- J. AWS D9.1 - Welding of Sheet Metal.
- K. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- L. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- M. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- N. SMACNA - HVAC Air Duct Leakage Test Manual.
- O. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- P. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 REGULATORY REQUIREMENTS

A. Construct ductwork to SMACNA, NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

2 PART 2 PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.
- B. Aluminum Ducts: Per ASTM B209-07 (For Pool Area rooms, which include: Pump Room A112, Chlorine Storage, and Acid Storage.)
- C. Steel Ducts: ASTM A366
- D. Insulated Flexible Ducts:
1. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
 2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 3. Maximum Velocity: 4000 fpm.
 4. Temperature Range: -10 degrees F to 160 degrees F.
- E. Fasteners: Rivets, bolts, or sheet metal screws.
- F. Sealant:
1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- G. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.
- I. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- J. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

a. AIR SYSTEM	MATERIAL
b. Low Pressure Supply	Steel
c. Return and Relief	Steel
d. General Exhaust	Steel
e. Outside Air Intake	Steel
f. Exhaust for Pump Room, Chlorine, and Acid Storage	Aluminum

B. DUCTWORK PRESSURE CLASS SCHEDULE

a. AIR SYSTEM	PRESSURE CLASS
b. Supply	1 inch
c. Return and Relief	1 inch
d. General Exhaust	1 inch
e. Outside Air Intake	1 inch

END OF SECTION 233100

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SECTION 233300 – AIR DUCT ACCESSORIES

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Volume control dampers.

1.2 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- B. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- C. UL 33 - Heat Responsive Links for Fire-Protection Service.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Ruskin, Louver & Damper, Or an approved equal.

2.2 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.3 BACKDRAFT DAMPERS.

- A. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage thick galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.4 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.5 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.6 VOLUME CONTROL DAMPERS.

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233423 – HVAC POWER VENTILATORS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

A. In-line exhaust fans.

1.2 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.

D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

F. NEMA MG1 - Motors and Generators.

G. UL 705 - Power Ventilators.

1.3 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Loren Cook(basis of design).

B. Acme,

C. Greenheck

D. Or an approved equal.

2.2 IN-LINE EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

3 PART 3 EXECUTION

3.1 INSTALLATION

A. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

B. In-line Fans:

1. Install fans with resilient mountings and flexible electrical leads.

2. Install flexible connections specified in Section 233300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Install backdraft dampers on inlet to roof and in-line exhausters.

E. Do not operate fans until ductwork is clean, filters are in place, and bearings are lubricated.

END OF SECTION 233423

SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.
- D. Roof hoods.

1.2 REFERENCES

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- C. ARI 650 - Air Outlets and Inlets.
- D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Anemostat
- B. Metalaire
- C. Titus(basis of design)
- D. Or an approved equal.

2.2 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, stamped, multi-louvered diffuser to discharge air in 360 degree pattern.
- B. Frame: Surface mount and Inverted T-bar type as required. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Steel with baked enamel off-white finish.
- D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.3 CEILING AND WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.
- B. Frame: 1 inch margin with concealed mounting.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with color to be determined by architect.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.4 LOUVERS

- A. Manufacturers:
 - 1. Louver & Dampers, Ruskin, or equal.
- B. Type: 4 inch deep with blades on 45 degree slope, heavy channel frame, birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.
- C. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish.
- D. Mounting: Furnish with interior angle flange for installation.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- D. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 233713

SECTION 238200 – UNIT HEATERS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric unit heaters.

1.2 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2 PART 2 PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Manufacturers:

1. Markel, Modine, Raywall, or equal.

B. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

I. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch.

3 PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

END OF SECTION 238200

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SECTION 26 05 01 – ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of all Division 26 sections.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical and related work is indicated by drawings and/or specified in other Division 26 sections.

1.3 DRAWINGS

- A. Drawings indicate general layout and operational requirements of electrical equipment and systems. Do not scale drawings for equipment sizes or exact locations.
- B. Do not deviate from requirements of drawings and specifications without written approval from Architect.

1.4 QUALITY ASSURANCE

- A. Material, equipment, and installation shall meet requirements of the edition in effect at project location of the National Electrical Code (NFPA 70) and all applicable local codes.
- B. All electrical material and equipment shall bear the UL label except in cases where UL does not label such types of materials and equipment.
- C. In the event of conflict between the drawings and specifications and the requirements of the applicable codes, the most stringent requirements shall prevail.
- D. Contractor shall have a minimum experience of five projects with multi-field installations of similar scope and size within the past five year. Provide proof of work and reference names.

1.5 SUBMITTALS

- A. Submit, to the Architect, manufacturer's data and shop drawings on equipment and materials as required by other sections of this specification. Clearly indicate proposed substitutions and deviations from contract drawings and specifications.
- B. Submit for Owner and Engineer review dimensioned drawings of electrical rooms showing all equipment locations in plan view and elevations of all walls.
- C. Proposed substitutions and deviations from the drawings and specifications that are not clearly indicated are hereby rejected.
- D. Approval of product data and shop drawings is not to be interpreted as permitting departure from contract documents.

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- E. Contractor shall approve submittals of product data and shop drawings before submission to the Architect. Approval by the Contractor will indicate general suitability for the application intended and that physical dimensions have been compared with installation space available and no interference will occur.
- F. Deliver to the Owner three (3) copies of a manual compiled in accordance with Division 1 of these specifications. Manual shall include record documents relating to the electrical equipment and systems including maintenance procedures and parts lists.
- G. Deliver to the Architect one set of record drawings neatly marked up to describe the electrical systems as installed. Record drawings shall show routing of all conduits and dimensioned locations of all underground and underfloor conduits.

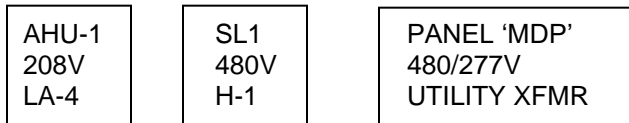
PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements, provide products of one of the manufacturers named unless the product of an approved equal is specifically indicated as being acceptable.

2.2 NAMEPLATES

- A. Nameplates shall be made of laminated plastic with a white center core sandwiched between two black layers. Letters shall be engraved, white, 3/8" high. Nameplates shall include the equipment designation on one-line, operational voltage on one line, and the name of the electrical panel including circuit number on one line. Similar to examples below:



2.3 SUPPORTING MATERIALS

- A. Supporting material shall be complete with necessary accessories to make a complete installation.
- B. Supporting material shall be galvanized steel unless indicated otherwise.

2.4 TELEPHONE TERMINAL BOARD

- A. Telephone terminal backboard shall be made of 3/4" marine grade plywood, painted with two coats of non- conductive, fire-retardant paint, flat gray, and be 4' by 8' unless indicated otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions under which electrical equipment is to be installed and notify Architect in writing of any conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

- B. Install electrical systems as indicated, complying with each respective manufacturer's written instructions, requirements of the applicable codes and standards, and in accordance with recognized industry practices.

3.2 COORDINATION

- A. Coordinate installation of new electrical service with local electric utility company. Provide concrete pad, trenching, conduit, connections, current transformer enclosures, meter bases and other facilities as required by local electric utility.
- B. Coordinate with local telephone company for new telephone service. Provide conduit, size as indicated, from telephone service point to telephone terminal board.
- C. Coordinate with local cable television company for new cable television service. Provide conduit, size as indicated, from cable television service point to telephone terminal board.
- D. Coordinate with other trades and approved submittals for requirements for electrical connections and control wiring as necessary for proper operation of all systems and equipment.
- E. Coordinate with other trades for information about electrical items such as starters and disconnect switches that may be furnished with equipment.
- F. Coordinate with other trades for locations of mechanical equipment, piping, ductwork, and architectural features to insure that required working clearances are maintained. Notify Architect of any interference that cannot be eliminated by minor adjustments.

3.3 CONNECTIONS

- A. Rough in for equipment connections according to approved submittals of related trades.
- B. Provide all equipment connections complete with motor controls, switches, wiring devices, control devices, protective devices, conduit, wiring, and other accessories as necessary for proper operation.
- C. When starters, control devices, or wiring are furnished as part of the controlled equipment, provide equipment connections, safety disconnect switches, conduit and other accessories as required.
- D. Equipment connections shall be as recommended by the manufacturer.

3.4 NAMEPLATES

- A. Install nameplates on each panelboard, disconnect switch, and remote control device.

3.5 OWNER FURNISHED EQUIPMENT

- A. Provide wiring and connections for Owner furnished equipment.
- B. Provide controls, receptacles, disconnect switches, conduit, wiring as required. Verify all requirements before rough in.

3.6 INSTRUCTION

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SECTION 26 05 01– ELECTRICAL GENERAL PROVISIONS

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- A. Instruct Owner's representatives in proper operation and maintenance of all electrical systems and equipment.

END OF SECTION 26 05 01

SECTION 26 05 19 – LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of electrical wire and cable work is indicated on drawings and/or specified in other Division 26 sections.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable packaged in factory containers.
- B. Store wire and cable in clean dry space protected from damaging fumes, construction debris, and traffic.
- C. Handle wire and cable carefully to avoid damaging insulation or sheathing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Power wire and cable:
 - 1. AFC
 - 2. Anaconda
 - 3. Kerite
 - 4. Rome
 - 5. Southwire
 - 6. Triangle PWC
 - 7. Alcan
 - 8. Or approved equivalent
- B. Cable for signal, data, and control:
 - 1. Belden
 - 2. West Penn
 - 3. Or approved equivalent

2.2 POWER WIRES AND CABLES

- A. Provide copper wires with UL Type THHN, or THWN insulation, of sizes indicated. Where sizes are not indicated, provide proper size wire to comply with the National Electrical Code.
- B. Provide type MC cable with separate green insulated equipment grounding conductor.
- C. Aluminum conductors with UL type XHHW-2 insulation may be used for feeders and service conductors, if allowed by local codes.

2.3 SIGNAL, DATA, AND CONTROL CABLES

- A. Provide factory fabricated, copper cables of sizes and sheathing as indicated. Where not indicated, provide proper cables to comply with requirements.
- B. All cables and cable supports installed open in air plenums shall be rated for plenum use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all power wiring in conduit. Pull conductors simultaneously where more than one is being installed in the same raceway.
- B. Branch circuits may be grouped for homeruns with three different phases, a shared neutral and a shared ground conductor in the same raceway. Increase size of neutral conductor where necessary due to harmonic currents.
- C. Do not install more than three current carrying conductors in any raceway.
- D. Type MC cable may be used for branch circuits rated at 20 amps where run concealed above ceilings and within walls.
- E. Low voltage signal wiring may be run open in accessible ceiling space. Provide conduit where signal wiring is run in or through walls and floors or through spaces with an open ceiling.

3.2 PULLING

- A. Use pulling compound or lubricant where necessary. Compound must not cause deterioration of insulation.

3.3 SPLICES

- A. Install splices and taps which possess equivalent or better ampacity, mechanical strength, and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

3.4 TIGHTENING

- A. Tighten electrical connections in accordance with manufacturer's published torque tightening values or to comply with tightening torque specified in UL STD 486A and B.

3.5 TESTING

- A. Subsequent to wire and cable connections, energize circuitry and demonstrate proper functioning.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Applications of grounding and bonding work in this section include the following:
 - 1. Service entrance ground.
 - 2. Separately derived systems.
 - 3. Enclosures.
- B. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide electrical grounding systems as indicated including all accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC and established industry standards.

2.2 CONDUCTORS

- A. Provide copper grounding conductors sized according to NEC.

2.3 GROUND RODS

- A. Provide copper clad steel ground rods, 10'-0" long and 3/4" in diameter.

PART 3 - EXECUTION

3.1 GROUND

- A. Install a ground system by bonding together the following (were available) at all structures:
 - 1. Metal building frame.
 - 2. Metal underground water pipe.
 - 3. Grounding rods.
 - 4. Concrete encased electrode.
- B. Connect ground bus of electrical equipment to service ground system with a grounding electrode conductor sized in accordance with NEC Table 250-66.

3.2 NEUTRAL/GROUND BOND

- A. The neutral and ground buses shall only be bonded together as allowed by the NEC.

SECTION 26 05 26 – GROUNDING AND BONDING

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- B. Connect the ground bus of service entrance equipment to the grounded conductor bus with a main bonding jumper sized in accordance with NEC Table 250-66.
- C. Connect the ground bus of separately derived systems to the grounded conductor bus with a main bonding jumper sized in accordance with NEC Table 250-66.
- D. Do not bond the neutral and ground buses together at structures served from another structure

3.3 GROUNDING RODS

- A. Install, and bond together, three ground rods arranged in a triangle 20 feet apart. Drive ground rods outdoors in an uncovered, unpaved area as near as possible to electrical service entrance.
- B. If soil conditions prevent installation of ground rods, install ground plates of equal surface area as deep as possible.

3.4 ENCLOSURE GROUNDING

- A. Install a green grounding conductor, sized as indicated or as required by the NEC, in each panel feeder conduit and each branch circuit conduit.
- B. Bond green grounding conductor to each electrical device, box, and equipment enclosure.

3.5 JUMPERS

- A. Install braided bonding jumpers with ground clamps on water piping to electrically bypass water meters.

3.6 TELEPHONE SYSTEM GROUNDING

- A. Provide a #6 copper grounding conductor in 1/2" PVC conduit from the service ground to a junction box at the telephone terminal board.

3.7 CONCRETE ENCASED ELECTRODE

- A. Install a minimum 20-foot length of #2 bare copper wire near bottom of foundation or footing. Wire shall be encased in minimum of 2" of concrete.

3.8 TESTING

- A. Measure the ground resistance of the service entrance ground with the neutral ground bonding jumper removed. If resistance to ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rod. Replace neutral ground bonding jumper prior to energizing the system.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of raceway and box work is indicated by drawings and specified in other Division 26 sections.

1.2 SUBMITTALS

- A. Submit manufacturer's data for the following:
 - 1. Surface metal raceways
 - 2. Exterior boxes
 - 3. Floor-mounted boxes

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide raceways of types and sizes as indicated, including bushings, couplings, offsets, elbows, expansion joints, adapters, and other components as needed for complete system.
- B. Where types and sizes are not indicated, provide raceways as required to fulfill requirements and comply with the National Electrical Code.

2.2 DEVICE AND OUTLET BOXES

- A. Provide galvanized steel device and outlet boxes of sizes as required.
- B. Provide boxes for electrical devices as well as telephone and other systems as required.
- C. Provide device and outlet box accessories as required that are compatible with boxes being used.
- D. Provide diecast aluminum device and outlet boxes for all exterior locations of sizes as required.

2.3 JUNCTION AND PULL BOXES

- A. Above-ground - Provide galvanized, welded seam, sheet steel junction and pull boxes of sizes as required. Boxes shall have screw-on covers and stainless steel screws.
- B. In-ground – Provide formed fiberglass or resin type junction and pull boxes of sizes required. Boxes shall have screw-on covers imprinted with the word “ELECTRIC” and stainless steel bolts.

2.4 BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS

- A. Provide corrosion-resistant knockout closures, conduit locknuts, and conduit bushings of types and sizes as required.

2.5 FLOOR BOXES

- A. Provide watertight, adjustable floor boxes with threaded conduit entrances, brass floor plates, flush screw-on covers and stainless steel cover screws.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate installation of raceway and electrical boxes and fittings with architectural finishes, casework, mechanical equipment, structural features, and wall-mounted equipment and devices.

3.2 INSTALLATION OF RACEWAYS

- A. All raceways shall be installed in accordance with manufacturers' instructions.
- B. Install electrical metallic tubing (EMT) within buildings but not in floor slabs or under slab on grade.
- C. Install non-metallic (PVC) conduit, schedule 40, within floor slabs, under slabs on grade, and underground outside buildings. Do not install PVC conduit inside buildings. Provide RSC elbow and vertical section on PVC conduit entering floor or ground.
- D. Install flexible conduit for motor connections and for other electrical equipment connections where subject to movement and vibration. Install liquid-tight flexible conduit where also subject to moisture.
- E. Install exposed runs of conduit, and conduit located above lay-in ceilings, parallel or perpendicular to walls. Install horizontal raceway runs above, and 6" away from, water and steam piping.
- F. Provide UL listed fire wall/floor penetration techniques where conduit penetrates fire rated walls or floors. See architectural drawings for identification of fire rated walls.
- G. Coat all underfloor and underground metal raceways with protective coating prior to placing concrete or backfill.
- H. Underground PVC conduits not encased in concrete shall be protected with 3" of sand on all sides.
- I. Install yellow plastic warning strip above buried raceways and 6" below finished grade.

3.3 SPARE CONDUITS

- A. Provide four 3/4" empty conduits with pull wires from each recessed panelboard to above nearest accessible ceiling. Provide other empty conduits, with pull wires, where indicated.
- B. All spare conduits shall be capped with watertight fitting.

3.4 FITTINGS

- A. Use sealing fittings where conduits pass from cold areas into areas of normal atmosphere or from hazardous areas into areas of normal atmosphere.

3.5 SEALING

- A. Install watertight sealing fittings in underground conduits at termination points in electrical enclosures.

3.6 PULL WIRES

- A. Provide pull wires in, and insulating bushings on, all conduits in which wiring is to be installed by others.

3.7 INSTALLATION OF BOXES

- A. Install electrical boxes as required to ensure accessibility to electrical wiring. Fasten boxes to structural members or embed in concrete.
- B. Provide a minimum of 24" horizontal separation between boxes installed on opposite sides of fire-rated or acoustic-rated walls.
- C. Position recessed outlet boxes level and plumb. No part of box or shall extend beyond finished surface.
- D. Ground each conductive electrical box upon completion of installation.
- E. Install in-ground electric boxes on a bed of gravel 6" longer and wider than the box, and at least 24" deep for drainage.

3.8 WEATHERTIGHT BOXES

- A. Provide weathertight boxes for locations exposed to weather or moisture. Provide watertight boxes for underwater and underground installation.

3.9 CLOSURES

- A. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- B. Provide covers on all pull boxes and junction boxes.
- C. Provide blank covers on all device and outlet boxes left for future use.

3.10 CLEANING

- A. After completion of installation, inspect interiors of raceways and boxes and remove all dirt and trash.

END OF SECTION 26 05 33

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SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of panelboard work is indicated on drawings.

1.2 SUBMITTALS

- A. Submit manufacturer's data on panelboards with all electrical characteristics clearly identified.
- B. Submit a dimensioned layout of all spaces containing more than two panelboards with the required electrical working clearances shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Panelboards:
 - 1. General Electric
 - 2. Square D
 - 3. Siemens
 - 4. Or approved equivalent.

2.2 GENERAL

- A. Provide dead front, factory-assembled circuit breaker or fused switch type panelboards as indicated. Panelboards shall have ratings, enclosures, and features as indicated and shall comply with manufacturer's standard design and construction.
- B. Panelboards shall be constructed with bus bars of tin plated aluminum or solid copper. The neutral bus shall be insulated from enclosure and the ground bus bolted to enclosure. "Load center" type panelboards are not acceptable.
- C. Equip panelboards with devices as indicated or as required. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Circuit breakers and fused switches shall comply with Section 262813 "Overcurrent Protective Devices."
- D. Panelboards shall be fully rated for interrupting ratings as indicated and shall be clearly labeled as such on the front of the panelboard.

2.3 SERVICE ENTRANCE PANELBOARDS

- A. Provide service entrance panelboard with a main circuit breaker or a main fused switch, as indicated, or with six or fewer branch switching devices. Neutral bus shall be bonded to ground bus with a removable jumper.

SECTION 26 24 16 – PANELBOARDS

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- B. Provide panelboards with UL markings indicating "suitable for use as service entrance equipment".

2.4 PANELBOARD ENCLOSURES

- A. Provide galvanized sheet steel enclosures of NEMA types as indicated, or as required, by same manufacturer as panelboards. Enclosures shall have a baked enamel finish over a rust inhibitor coating and be suitable for recessed or surface mounting as indicated.
- B. Enclosures shall have doors with concealed piano hinges, flush locks and keys with all enclosures keyed alike. Equip with interior circuit directory frame, and card with clear plastic covering.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Anchor enclosures firmly to walls and structural surfaces such that they are mechanically secure.
- B. Bond ground buses together in two section panelboards. Bonding conductor shall be copper of same size as panelboard feeder ground conductor.

3.2 DIRECTORY

- A. Fill out panelboard circuit directory card upon completion of installation work using a typewriter.
- B. Directory shall describe type of load and location for each branch circuit using Owners' space names or numbers.
- C. Information on directory card shall include name and location of panelboard serving this panelboard.

3.3 IDENTIFICATION

- A. Provide "Service Disconnect" label on all service disconnect switches.

3.4 GROUNDING

- A. Provide equipment-grounding connections for panelboards.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated on drawings.

1.2 SUBMITTALS

- A. Submit manufacturer's data on wiring devices and covers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Receptacles, Switches, and Wallplates:

- General Electric

- Hubbell

- Leviton

- Pass and Seymour

- Or approved equivalent

2.2 GENERAL

- A. Provide factory fabricated wiring devices of types and electrical ratings indicated.
- B. Provide ivory color devices unless indicated otherwise. Verify color with Architect.
- C. All wall plates shall be stainless steel.

2.3 DUPLEX RECEPTACLES

- A. Provide specification grade duplex receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke.
- B. Duplex receptacles shall be rated 15 amperes, 125 volts, NEMA 5-15R, unless indicated otherwise.
- C. All receptacles in wet locations, outdoors, and on roofs shall be weather resistant ground fault interrupter type.

2.4 MISCELLANEOUS RECEPTACLES

- A. All other receptacles shall be of same quality as general duty duplex type. Ratings shall be as indicated.

2.5 GROUND FAULT INTERRUPTER RECEPTACLES

SECTION 26 27 26 – WIRING DEVICES

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- A. Provide termination type ground fault circuit-interrupter duplex receptacles, grounding type rated 20 amperes, 120 volts, 60 Hz, with solid-state ground-fault sensing, 5 milliamperes trip level, NEMA 5-15R.

2.6 SWITCHES

- A. Provide specification grade switches, 20 ampere, 120- 277 volts AC, with mounting yoke insulated from mechanism. Switch shall be single pole, two-pole, three-way, or four-way as described on drawings.

2.7 WALLPLATES

A. INTERIOR

- 1. Provide stainless steel covers with stainless steel screws.

B. EXTERIOR

- 1. Provide die cast steel, weatherproof while in use, with die cast covers and hasp to allow locking by pad lock. Color shall be Gray.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices in clean electrical boxes after wiring work is complete. Install wallplates after painting work is complete.

3.2 RATINGS

- A. Install receptacles with current rating equal or greater than current rating of circuit overcurrent protective device on single-receptacle circuits.
- B. Install a 120-volt, 15-amp, GFI duplex receptacle in a weatherproof enclosure within 25 feet of exterior air conditioning equipment.

3.3 GROUNDING

- A. Provide equipment-grounding connections for wiring devices.

3.4 TESTING

- A. Test each wiring device for proper operation and proper polarity. Make corrections as necessary.

END OF SECTION 26 27 26

SECTION 26 28 13 – OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of overcurrent protective device work is indicated on drawings.

1.2 SUBMITTALS

- A. Submit manufacturer's data on overcurrent protective devices with all electrical characteristics clearly identified.
- B. Submit manufacturer's information indicating that all series rated systems are UL recognized.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Circuit Breakers:
 - General Electric
 - Square D
 - Or approved equivalent
- B. Fuses:
 - Bussmann
 - Littelfuse
 - Reliance/Brush
 - Or approved equivalent

2.2 GENERAL

- A. Provide circuit breakers and fuses of types, sizes, ratings and characteristics indicated which comply with manufacturer's standard design.
- B. Circuit breakers used for switching of fluorescent lighting shall be listed for switching duty and marked "SWD".
- C. Circuit breakers used for switching of high intensity discharge lighting shall be listed for switching duty and marked "HID".

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. Provide factory-assembled, molded-case circuit breakers of frame size, trip rating, voltage, poles and interrupting ratings as indicated.

- B. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole and with trip-free type operating mechanisms and positive handle indication. Breakers shall be suitable for operating in any position in an ambient temperature of 40 degrees C.

2.4 FUSES

- A. Circuits rated at 601 to 6000 amps shall be protected by current limiting, UL class L, time delay fuses with a minimum interrupting rating of 200,000 amps symmetrical. Fuses shall be Bussman Low-Peak KRP-C or approved equivalent.
- B. Circuits rated at 15 to 600 amps shall be protected by current limiting, UL class RK1, time delay fuses with a minimum interrupting rating of 200,000 amps symmetrical. Fuses shall be Bussman Low-Peak LPN-RK (250 volt) or LPS-RK (600 volts), or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or conductors.
- B. Fuses shall be shipped separately from switchboard and shall be field installed immediately prior to energization of the circuit in which they are applied.

3.2 SPARE FUSES

- A. Provide, to the Owner, three spare fuses of each type and size installed.

3.3 INSPECTION

- A. Inspect circuit breaker operating mechanisms and adjust units for free mechanical movement.

END OF SECTION 26 28 13

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of enclosed switches and circuit breaker work is indicated on drawings.

1.2 SUBMITTALS

- A. Submit manufacturer's data on enclosed switches and circuit breakers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Enclosed switches and circuit breakers:

- General Electric

- Square D

- Siemens

- Or approved equivalent

2.2 GENERAL

- A. Provide fusible and non-fusible, surface-mounted, enclosed switches and circuit breakers of types, and ratings as indicated. Provide quick-make, quick-break switches constructed so that blades are visible in OFF position with door open. Switches and circuit breakers shall have operating handles capable of being padlocked in OFF position. Current carrying parts shall be copper with silver-tungsten contacts.
- B. Provide switches and circuit breakers with NEMA Type 1 enclosures for indoor locations and NEMA Type 3R enclosures for outdoor locations unless indicated otherwise.
- C. Provide general duty switches on circuits where the phase-to-phase voltage does not exceed 240 volts unless indicated otherwise on drawings.
- D. Provide heavy duty switches on circuits with phase-to-phase voltage of 480 volts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install switch or circuit breaker within sight of starter location for each hardwired motor driven appliance and at other locations as indicated on Drawings.
- B. Install switches and circuit breakers for use with heating, ventilation, and air conditioning equipment within six feet of units or components.
- C. For interior equipment visible from floor, mount switch or circuit breaker with bottom at 48" above floor.

SECTION 26 28 16– ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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- D. For exterior equipment mount switch or circuit breaker with bottom at 36" above grade or concrete pad.
- E. Insure that electrical working clearances are maintained at each switch and circuit breaker.

3.2 SUPPORT

- A. Support each switches and circuit breakers from wall or other structural components as close as possible to associated starter or motor. Do not attach to any appliance or equipment housing unless specifically permitted by manufacturer of appliance or equipment.
- B. Provide independent steel channel supports for switches and circuit breakers at appliances and equipment not near a wall.

3.3 GROUNDING

- A. Provide equipment grounding connections for all electrical switches and circuit breakers.

END OF SECTION 26 28 16

SECTION 26 43 13 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide surge protective devices (SPD's) at the service equipment and at other panelboards as indicated.

1.2 QUALITY ASSURANCE

- A. Comply with applicable requirements of most recent edition of ANSI/IEEE C62.41, "IEEE Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits".
- B. Comply with applicable requirements of most recent edition of UL 1449, "Standard for Safety, Surge Protective Devices".
- C. Provide surge protective device that is UL listed and labeled.
- D. Equipment and installation shall conform to NEC Article 285 "Surge Protective Devices (SPD)".
- E. Provide to the Owner a five-year warranty covering all parts.
- F. Listed voltage protection rating (VPR) indicated below shall be in accordance with the most recent edition of UL 1449.

1.3 SUBMITTALS

- A. Submit manufacturer's data and installation instructions for surge protective devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide surge protective devices by one of the following:
 - 1. Advanced Protection Technologies
 - 2. Current Technologies
 - 3. Innovative Technology
 - 4. General Electric
 - 5. Sentrex
 - 6. Square D
 - 7. Surge Protection, Inc.
 - 8. Or approved equivalent

2.2 GENERAL

- A. Provide solid state, bi-directional SPD's with surge current diversion paths for all modes of protection; L-L, L-N, L-G, N-G.
- B. SPD device shall be marked with a short circuit current rating that is equal to, or greater than, the short circuit current rating of the panelboard or switchboard at which it is installed.
- C. Indicator lights shall indicate proper connection and "device failure".
- D. Device failure shall not cause interruption of power to panel or equipment.
- E. SPD equipment that is integral to the panelboard or switchboard is acceptable.
- F. Listed voltage protection ratings (VPR's) shall not exceed the following:

<u>System Voltage</u>	<u>L-N</u>	<u>L-G</u>	<u>L-L</u>	<u>N-G</u>
120/208V	700V	700V	1200V	700V
277/480V	1200V	1200V	1800V	1200V

2.3 SPD AT SERVICE EQUIPMENT

- A. Single pulse surge current capability, per phase, of no less than 240,000 amps.

2.4 SPD AT DISTRIBUTION PANELBOARDS

- A. Single pulse surge current capability, per phase, of no less than 160,000 amps.

2.5 SPD AT BRANCH PANELBOARDS

- A. Single pulse surge current capability, per phase, of no less than 100,000 amps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install surge protective devices in accordance with manufacturers' instructions.
- B. If overcurrent protection is not indicated on the drawings and SPD does not have integral overcurrent protection, provide a separately enclosed fused switch or circuit breaker adjacent to the panelboard or switchboard for the SPD.
- C. SPD shall be mounted directly to switchboards and to surface mounted panelboards.
- D. SPD at recessed panelboards shall be installed in a recessed cabinet adjacent to panelboard.
- E. The conductor length from switchboard or panelboard to SPD shall be the absolute minimum possible with no sharp bends. Conductor length shall not exceed 24 inches without approval by Engineer.

END OF SECTION 26 43 13

SECTION 26 51 13 – LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of lighting fixture work is indicated on drawings.

1.2 QUALITY ASSURANCE

- A. Comply with applicable requirements of NEMA Standards LE 1 and LE 2 pertaining to lighting equipment.
- B. Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.3 SUBMITTALS

- A. Submit manufacturer's data on lighting fixtures. Submit complete photometric characteristics on proposed substitutions.
- B. Submit list of lamps proposed including manufacturer's name and catalog number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lighting fixtures:
 - As indicated on LIGHTING FIXTURE SCHEDULE or an approved equal.
- B. Lamps:
 - General Electric
 - Philips
 - Sylvania
 - Or approved equivalent
- C. Fluorescent emergency battery systems:
 - Bodine B50
 - Iota I-80
 - Or approved equivalent
- D. Compact fluorescent emergency battery systems:
 - Bodine
 - Iota
 - Or approved equivalent

2.2 GENERAL

- A. Provide lighting fixtures of sizes, types, ratings, and with accessories and features indicated. Substitutions must be of equal quality and photometric performance and similar in appearance to specified fixtures.
- B. Fixtures shall be complete with lamps, ballasts, and all parts, and accessories required for installation and proper operation.
- C. Fixtures mounted outdoors, exposed to weather, shall be UL listed for wet location.

2.3 LAMPS

- A. Provide clear lamps for outdoor fixtures and inside frosted lamps for indoor fixtures unless noted otherwise on drawings.
- B. Incandescent A-lamps shall be extended service type with a minimum of 2500 hours average rated life.
- C. Fluorescent lamps, unless noted otherwise, shall be T8 type.
- D. Light Emitting Diode (LED) Lamps:
 - 1. Lumen output associated with LED light fixtures shall as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on submittals.
 - 2. Individual LEDs shall be connected such that catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

2.4 BALLASTS

- A. Fluorescent lamp ballasts shall be as described in Lighting Fixture Schedule or, if not described in schedule, as recommended by fixture manufacturer.
- B. HID lamp ballasts shall be as recommended by lamp manufacturer, which properly matches lamps to branch, circuit voltage.

2.5 POLES AND POLE BASES

- A. Provide poles as indicated on drawings. Unless indicated otherwise, poles shall be square steel painted to match lighting fixture. Size poles as required to support fixtures installed in wind speeds of 100 miles per hour.
- B. Provide pole bases as required for local soil conditions. Pole base details on drawings are minimum requirements only. Contractor shall employ a civil/ structural engineer to verify that pole base installed is adequate for pole/fixture assembly at site location.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install interior lighting fixtures at locations and heights as indicated in accordance with fixture manufacturers' instructions. Fasten fixtures securely to structural support and ensure that pendant mounted fixtures are plumb.

3.2 COORDINATION

- A. Coordinate with structural members, piping and ductwork locations for interferences and notify Engineer of any interference that cannot be avoided by minor adjustments in location.

3.3 EMERGENCY LIGHTING

- A. Connect unit emergency equipment to line side of lighting switches such that emergency operation begins automatically upon loss of normal power but not when switch is turned off.
- B. Provide a handle lock on branch circuit breakers serving dedicated emergency lighting circuits and night lighting circuits.

3.4 MECHANICAL ROOMS

- A. Install lighting fixtures in mechanical rooms to illuminate all electrical equipment and all gages and service locations on mechanical equipment.

3.5 CLEANING

- A. Clean lighting fixtures upon completion of installation. Protect installed fixtures from dirt and damage.

3.6 TESTING

- A. Demonstrate proper operation of lighting system. Correct or replace malfunctioning units and retest.

3.7 GROUNDING

- A. Provide equipment-grounding connections for each lighting fixture.

END OF SECTION 26 51 13

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SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for walks pavements lawns and grasses and exterior plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks pavements.
 - 5. Subbase and base course for asphalt paving.
 - 6. Subsurface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling for utility trenches.
 - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 1 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
 - 2. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 - 3. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
 - 4. Division 1 Section "Temporary Tree and Plant Protection" for protecting and trimming trees to remain.
 - 5. Division 33 Section "Dewatering" for lowering and disposing of ground water during construction.
 - 6. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 - 7. Division 33 Section "Site Subdrainage" for drainage of foundations slabs-on-grade walls and landscaped areas.
 - 8. Division 32 Section "Lawns and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
 - 9. Division 32 Section "Exterior Plants" for planting bed establishment and tree and shrub pit excavation and planting.
 - 10. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
 - 11. Divisions 22, 23 and 26 Sections for installing underground plumbing, mechanical and electrical utilities and buried plumbing, mechanical and electrical structures.

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1.3 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. 24 inches outside of concrete forms other than at footings.
 2. 12 inches outside of concrete forms at footings.
 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 5. 6 inches beneath bottom of concrete slabs-on-grade.
 6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
 7. 6 inches beneath subgrade of pavement, turf and lawn areas

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Rock (Trench Excavation), Excavation of Footings, Trenches and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not

less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.

2. Rock (Open Excavation): Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:
 1. Geotextile.
 2. Controlled low-strength material, including design mixture.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.

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- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 1 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. See Geotechnical Information provided to bidders for other information. If information conflicts, definitions in Geotechnical Information provided to bidders takes precedence.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. See Geotechnical Information provided to bidders for other information. If information conflicts, definitions in Geotechnical Information provided to bidders takes precedence.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- K. Topsoil: Free from roots and vegetation (with no items larger than 1/2") as stripped on the site or as approved by the Owner's Representative for material imported to the site. If imported, it shall be natural, fertile, friable, productive soil, neither excessively acid nor alkaline, and free from toxic substances, stones, weeds, clay, clods, roots, cinders, and debris. Topsoil to be

placed on lawns or sports fields to be sifted to be free of debris. Topsoil on areas to receive Love Grass does not have to be sifted.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: per GDOT specifications.
7. Permittivity: per GDOT specifications; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 140 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495.

2.4 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system, specified in Division 33 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Blasting:

1. Owner representative shall be notified before any rock is blasted or removed in any way.
2. Obtain written permission from authorities having jurisdiction before bringing explosives to Project Site or using explosives on Project Site.
3. All blasting shall be done in accordance with local ordinances, and permits shall be obtained by Contractor where required by law.
4. Measurements for limits of rock to be blasted will be determined by geotechnical firm and Owner representative.
5. Perform blasting without damaging adjacent structures, property, or site improvements. Seismographic monitoring during blasting and video documentation will be required.
6. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.”

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

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2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

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- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas (Outside sports fields): Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 33 Section "Site Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 90 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 90 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.

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5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent geotechnical engineering testing agency will be engaged to perform field quality-control testing. Testing agency will be engaged as outlined in the Special Provisions.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each or less of trench length, but no fewer than 2 tests.

- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 00 00

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees shrubs groundcovers plants and grass to remain.
 - 2. Removing existing trees shrubs groundcovers plants and grass.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping, or sealing, and removing site utilities.
 - 7. Temporary erosion and sedimentation control measures.

1.2 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.3 MATERIAL OWNERSHIP

- A. Except for topsoil stripping and materials indicated to remain the Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

- A. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

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- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, a sediment and erosion control plan, specific to the site that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Tree protection shall comply with the local municipality having jurisdiction on the project. Contractor shall be familiar with all local requirements.
- B. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.

- C. Do not excavate within tree protection zones, unless otherwise indicated.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.
 - 1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

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- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

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

END OF SECTION 31 10 00

SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.
 - 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
 - 4. Remove dewatering system if no longer needed.

1.3 SUBMITTALS

- A. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if

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changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level as recommended by testing agency below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on a continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 31 23 19

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SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SCOPE

- A. Provide all of the labor, materials, equipment, and services required to complete the soil poisoning work.
- B. Prevent termite, carpenter ant and other wood destroying insect infestation.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Soil treatment with termiticide.
 - 2. Wood treatment with borate.

1.3 QUALITY ASSURANCE:

- A. In addition to requirements of these Contract Documents, comply with the manufacturer's instructions and recommendations for work, including preparation of substrate and application.
- B. The applicator shall be a company specializing in soil treatment for insect control with a minimum of one year of documented experience.
- C. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.
- D. Work shall conform to rules and regulations for pest control as determined by the State in which the Project is being constructed.
- E. Products shall conform to the requirements of the U.S. Environmental Protection Agency (EPA) regulations for insecticides.

1.4 SUBMITTALS:

- A. Product Data: For termiticide
 - 1. Include the EPA-Registered Label for termiticide products.
 - 2. Indicate toxicant to be used, composition by percentage, dilution schedule, and intended application rate.
- B. Product Certificates: For termite control products, signed by product manufacturer.
- C. Qualification Data: For Installer of termite control products.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.

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5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

1.5 WARRANTY

- A. Form of warranty: The warranty shall be in a form acceptable to the Architect and shall be drawn in favor of the Owner, his successor, and his assigns.
- B. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation, at no cost to Owner.
 1. Warranty Period: Five years from date of substantial completion.
- C. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied wood termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood
 1. Warranty Period: 12 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 1. Products: Use an emulsified concentrate insecticide for dilution with water, specially formulated to prevent infestation by insects. Fuel oil will not be permitted as diluent.
 2. Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. Ensystem; Maxxthor SC
 - d. FMC Corporation, Agricultural Products Group; Dragnet SFR or Prevail FT

2.2 WOOD TREATMENT

- A. Borate: Provide an EPA-registered borate complying with requirements of authorities having jurisdiction, in an aqueous solution for spray application and a gel solution for pressure injection, formulated to prevent termite infestation in wood. Provide quantity required for application at the label volume and rate for the maximum diffusible borate concentration allowed for each specific use, according to product's EPA-Registered Label.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Nisus Corp.; Bora-Care.

- b. NovaGuard Technologies, Inc.; Armor-Guard, Shell-Guard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

- 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

- 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

- 1. Slabs-on-Grade and Basement Slabs: Ground supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
 - 5. Where exterior is abutted by concrete slabs, asphalt, or other permanent surfacing, treat exterior sides at the same rate.

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6. Outside building perimeter in a strip at least 2'-0" wide, under porches, areaways, aprons, pads, stair landings or paved extensions.
 7. In absorbent soil or fill (sand, sand and gravel mix, gravel) increase the application rate as recommended by the manufacturer.
 8. Application rates shall be in accordance with the manufacturer's instructions.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Re-apply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.
- F. Allow not less than 12 hours for drying after application before beginning concrete placement or other construction activities.

3.5 APPLYING WOOD TREATMENT

- A. Application: Mix wood treatment solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of borate, according to manufacturer's EPA-Registered Label, so that wood framing, sheathing, siding, and structural members subject to infestation receive treatment.
1. Framing and Sheathing: Apply termiticide solution by spray to bare wood for complete coverage.
 2. Wood Members More Than 4 Inches Thick: Inject termiticide gel solution under pressure into holes of size and spacing required by manufacturer for treatment.
 3. Exterior Uncoated Wood Trim and Siding: Apply termiticide solution to bare wood siding. After 48 hours, apply a seal coat of finish as specified in Division 09 "Painting".

END OF SECTION 31 31 16

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes temporary excavation support and protection systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

- 1. Prevent surface water from entering excavations by grading, dikes, or other means.
- 2. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.3 SUBMITTALS

- A. Qualification Data: For Installer and professional engineer.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

- 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
- 2. The geotechnical report is referenced elsewhere in the Project Manual.

- C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

- 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 SOLDIER BEAMS AND LAGGING

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

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
 - 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
 - 2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 31 50 00

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Pavement-marking paint.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.
 - 2. Division 32 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
 - 1. Standard Specification: GDOT Standard Specifications for Road and Bridge Construction, latest edition.
 - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

- A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- B. Job-Mix Designs: For each job mix proposed for the Work.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

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- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with standards of GDOT for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Per GDOT standards

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: AASHTO M 29, Grade Nos. 2 or 3.
- C. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.
 - 1. Color: As indicated.
- D. Glass Beads: AASHTO M 247, Type 1.
- E. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, sized per drawings. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: As indicated
 - 3. Surface Course: As indicated
- B. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: As indicated
 - b. Surface Course: As indicated

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

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3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
- D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

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1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. Base Course: Per GDOT standard
 2. Surface Course: Per GDOT standard
 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.

3.9 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing and inspecting agency will be engaged to perform field tests and inspections and to prepare test reports. Testing agency will be engaged as outlined in the Special Provisions.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

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SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Curbs and gutters.
2. Walkways.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.3 SUBMITTALS

A. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

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.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

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- B. 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.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 420; deformed.
- C. Plain Steel Wire: ASTM A 82, galvanized.
- D. Deformed-Steel Wire: ASTM A 496.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 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.

2.4 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.

1. Color: As indicated.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

- B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 3500 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

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3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing admixture high-range, water-reducing admixture high-range, water-reducing and retarding admixture plasticizing and retarding admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:
 1. Fly Ash or Pozzolan: 25 percent.
 2. Ground Granulated Blast-Furnace Slag: 50 percent.
- G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared sub-base surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 1. Completely proof-roll sub-base in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
 3. Sub-base with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earthwork."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted sub-base surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long 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.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals as indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from sub-base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten sub-base to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.

- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact sub-base and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- O. Cold-Weather Placement: Comply with 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 air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing and inspecting agency will be engaged to perform field tests and inspections and prepare test reports. Testing agency will be engaged as outlined in the Special Provisions.
- B. Testing Services: 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 at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 - 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 mix. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 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. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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.
- D. 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.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittal Procedures" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

2.3 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

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SECTION 32 31 13 - CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Chain-Link Fences
2. Gates

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:
 - a. Wind Speed: 80 mph.
 - b. Fence Height: at 10' tall
 - c. Line Post Group: IA, ASTM F 1043, Schedule 40 steel pipe.
 - d. Wind Exposure Category: C.
2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

1. For installed products indicated to comply with design loads, include structural analysis data.

C. Samples for Initial Selection: Manufacturer's color charts or 6-inch lengths of actual units showing the full range of colors available for components with factory-applied color finishes.

D. Samples for Verification: For each type of chain-link fence and gate indicated.

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1. Polymer-coated steel wire (for fabric) in 6-inch lengths.
 2. Polymer coating, in 6-inch lengths on shapes for posts, rails, wires, and gate framing and on full-sized units for accessories.
- E. Field quality-control test reports.
- F. Maintenance Data: For the following to include in maintenance manuals:
1. Polymer finishes.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified according to NETA ETT, or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management Coordination."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
- B. Interruption of Existing Utility Service: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of utility services.
 2. Do not proceed with interruption of utility services without Architect's written permission.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Height indicated on Drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: Polymer-coated wire –see plans for gauge of core wire.
 - a. Mesh Size: 1 1/2 inches, per DeKalb County Pool Code.
 - b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
 - c. Polymer Coating: Fusion-bonded PVC – color black.
 - d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
2. Selvage: Knuckled at both selvages.

2.2 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
 1. Group: IA, round steel pipe, Schedule 40.
 2. Fence Height: indicated on drawings.
 3. Strength Requirement: Heavy industrial according to ASTM F 1043.
 4. Post Diameter and Thickness: According to ASTM F 1083.
 - a. Line Post: indicated on drawings.
 - b. End, Corner and Pull Post: indicated on drawings.
 - c. Swing Gate Post: indicated on drawings.
5. Coating for Steel Framing:
 - a. Metallic Coating:
 - 1) Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - 2) External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc pigmented coating.
 - 3) Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
 - 4) Coatings: Any coating above.
 - b. Polymer coating over metallic coating.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
 1. Location: Extended along bottom of fence fabric
 2. Location: as indicated on drawings.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
 1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

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- a. Class 1: Not less than 0.8 oz./sq. ft. of uncoated wire surface.
 - b. Class 2: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
 - c. Class 3: Not less than 2 oz./sq. ft. of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.
2. Metallic Coating: Type III, Zn-5-Al-MM alloy with the following minimum coating weight:
 - a. Class 1: Not less than 0.6 oz./sq. ft. of uncoated wire surface.
 - b. Class 2: Not less than 1 oz./sq. ft. of uncoated wire surface.
 - c. Matching chain-link fabric coating weight.

2.4 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for single and double swing gate types.
 1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from round tubing with outside dimension and weight according to ASTM F 900 and the following:
 1. Gate Fabric Height: As indicated.
 2. Leaf Width: As indicated.
 3. Frame Members:
 - a. Tubular Steel: as indicated.
- C. Frame Corner Construction:
 1. assembled with corner fittings.
- D. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post and Line Caps: Provide for each post.
 1. Line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Rail Clamps: Line and corner boulevard clamps for connecting intermediate bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- I. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
 - 2. Aluminum: Mill finish.

2.6 POLYMER FINISHES

- A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.
- B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 1.
- C. Metallic-Coated Steel Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.
 - 1. Polymer Coating: Not less than 10-mil- thick PVC finish.
- D. Color: Match chain-link fabric, complying with ASTM F 934.
- E. All fence posts and rails to be polyester powder coated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at as indicated.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at mid-height of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Bottom Rails: Install, spanning between posts.
- I. Chain-Link Fabric: Apply fabric to inside (facing ballfield) of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Owner will engage a qualified independent testing and inspecting agency to perform field quality-control testing.
 - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - 3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 32 31 13

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SECTION 32 31 19 – ALUMINUM ORNAMENTAL FENCE SYSTEM

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 31 00 00 – Earthwork
- C. Section 03 30 01 – Concrete
- D. Section 32 13 13 – Concrete Paving

1.2 SYSTEM DESCRIPTION

- A. The manufacturer shall supply a total ornamental aluminum fencing system of the Ameristar Echelon Plus® Majestic™ 3-rail design or approved equal. The system shall include all components (i.e., pickets, posts, rails, gates and hardware) required.

1.3 QUALITY ASSURANCE

- A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and the materials specified.

1.4 REFERENCES

- A. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- C. ASTM D523 - Test Method for Specular Gloss.
- D. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- E. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- F. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- G. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- H. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

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1.5 SUBMITTAL

- A. The manufacturer's submittal package shall be submitted prior to installation to confirm compliance with all requirements for materials specified in this section.

1.6 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism, and theft.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. The ornamental fence system shall conform to Ameristar's Echelon Plus aluminum ornamental fencing, Majestic, 3-rail, style manufactured by Ameristar Fence Products, Inc. in Tulsa, Oklahoma, or approved equal.

2.2 MATERIAL

- A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.
- B. Pickets shall be 3/4" square x .045" thick. Horizontal rails shall be 1-1/4" x 1-7/16" Forerunner™ channel with .060" thick top & internal web wall, and .090" thick side walls and shall be punched to allow picket to pass through the top of the rail. The Forerunner rail shall be constructed with an internal web insert providing a raceway for the pickets to be retained with a 1/8" retaining rod. The number of rails shall vary with the style, height and strength as determined by manufacturer. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
- C. Accessories: Aluminum castings shall be used for all post caps, scrolls, finials, and other miscellaneous hardware. Hinges and latches shall be fabricated from aluminum, stainless steel or composite materials.

2.3 FABRICATION

- A. Pickets, rails, and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
- B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

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- C. Finish: All fence components shall be subject to a six-stage pretreatment/wash followed by an electrostatic spray application of a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2-4 mils. The color shall be black.
- D. Completed panels shall be capable of supporting a 200 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.
- E. Swing gates shall be fabricated using 1-1/4" x 1-7/16" Forerunner rail, 1.75" sq. x .125" gate ends, and 3/4" sq. x .080 pickets. Gates that exceed 6' in width will have a 1.75" sq. x .125" intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.2 FENCE INSTALLATION

- A. Fence post shall be spaced according to Table 3, plus or minus 1/2". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers 33" depth recommended (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.3 FENCE INSTALLATION MAINTENANCE

- A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces; 1) Remove all metal shavings from cut area. 2) Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1 & 2 above will negate warranty. Ameristar spray cans or paint pens shall be used to finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.4 GATE INSTALLATION

- A. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.5 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

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Table 1 – Minimum Sizes for Echelon Plus Posts	
<u>Fence Posts</u>	<u>Panel Height</u>
3" x 3" x .060" w/ reinforced web	42"

Table 2 – Coating Performance Requirements		
<u>Quality Characteristics</u>	<u>ASTM Test Method</u>	<u>Performance Requirements</u>
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 1000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Echelon Plus – Post Spacing By Bracket Type				
Span	6' Nominal (73-1/16" Rail)			
Post Size			3"	3"
Bracket Type		Echelon Plus Swivel* (ABB2)		Echelon Plus Flat Mount (ABB1)
Post Settings ± 1/2" O.C.			*76-3/4"	76-3/4"
*Note: When using ABB2 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.				

END OF SECTION 32 13 19

SECTION 32 92 00 - LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
2. Sodding.
3. Sprigging.
4. Erosion-control material(s).

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
1. Certification of each seed mixture for turfgrass sod, identifying source, including name and telephone number of supplier.
- B. Material Test Reports: For existing surface soil and imported topsoil.
- C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required initial maintenance periods.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

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- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. SPECIAL NOTE RELATED TO SEEDING: SEE SPECIAL PROVISIONS FOR LANGUAGE RELATED TO RELEASE OF PAYMENT AND OWNER ACCEPTANCE RELATED TO ESTABLISHMENT OF TURF.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.7 MAINTENANCE SERVICE

- A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
 - 2. Sodded Lawns: 30 days from date of planting completion.
 - 3. Sprigged Lawns: 60 days from date of planting completion.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species, as follows:
 - 1. Full Sun: Bermudagrass (Cynodon dactylon '419 Hybrid').

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform

density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: as indicated on plans

2.3 SPRIGS

A. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and attached roots free of soil, of the following turfgrass species:

1. Turfgrass Species: as indicated on plans

2.4 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. See Earthwork for additional information.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.5 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

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- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.6 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/meter (dS/m); not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb./cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb./cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, un-leached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.7 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.8 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb./1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.9 MULCHES

- A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.10 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydro-seeding and hydro-mulching overspray.
 2. Protect grade stakes set by others until directed to remove them.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.

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- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply commercial fertilizer (10-10-10) fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
 - 4. See Earthwork section for additional information for preparation of sand base material and laser grading required for sprigged areas.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply commercial fertilizer (10-10-10] fertilizer directly to surface soil before loosening.
 - 3. If not already required by Earthwork sections, remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future. See Earthwork specifications for additional information.
- E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Lawn Preparation" Article.
- B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

- C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow Common Bermuda seed at a total rate of 75lbs/acre
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydro-seed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 - 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate per manufacturer's recommendations, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 SPRIGGING

- A. Broadcast sprigs uniformly over prepared surface at a rate of 650 bushels/acre and mechanically force sprigs into lightly moistened soil.
 - 1. Spread a 1/4-inch- thick layer of topsoil on sprigs.
 - 2. Lightly roll and firm soil around sprigs after planting.

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3. Water sprigs immediately after planting and keep moist by frequent watering until well rooted.

3.9 LAWN MAINTENANCE

- A. Lawn maintenance is the responsibility of the contractor until final acceptance.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and add new mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 2. Water lawn with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Mow at least 3 times and as needed to maintain healthy lawn. Remove no more than 1/3 of grass-leaf growth with any mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height:
 1. Mow grass to a height of 1/2 inch or less.
 2. Mow grass to a height of 1/2 to 1 inch.
 3. Mow grass to a height of 1 to 2 inches.
 4. Mow grass to a height of 2 to 3 inches.
- E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.
 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

3.10 SATISFACTORY LAWNS

- A. Lawn installations shall meet the following criteria as determined by Architect:
 1. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 6 by 6 inches.
- B. SPECIAL NOTE RELATED TO SEEDING: SEE SPECIAL PROVISIONS FOR LANGUAGE RELATED TO RELEASE OF PAYMENT AND OWNER ACCEPTANCE RELATED TO ESTABLISHMENT OF TURF IN AREAS REQUIRING SEEDING.
 1. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

2. Satisfactory Sprigged Lawn: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants; and areas between sprigs are free of weeds and other undesirable vegetation.
- C. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.
- C. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

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SECTION 32 93 00 - EXTERIOR PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Trees.
 2. Shrubs.
 3. Ground cover.
 4. Plants.
 5. Tree stabilization.
 6. Edgings.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlap Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
- D. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of exterior plant required.
- E. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.
- F. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.
- G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.
- H. Finish Grade: Elevation of finished surface of planting soil.
- I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- J. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

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- K. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- L. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- M. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- B. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
 - 1. Selection of exterior plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.
- E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 16-inches above the ground for trees up to 4-inch caliper size, and 12-inches above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- F. Observation: Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and

root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

1. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

B. Do not prune trees and shrubs before delivery except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 PROJECT CONDITIONS

A. Planting and Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed according to manufacturer's written instructions and warranty requirements.

B. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.7 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

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- a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty operation of tree stabilization edgings.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods from Date of Substantial Completion:
- a. Trees and Shrubs: One year.
 - b. Ground Cover and Plants: One year
3. Include the following remedial actions as a minimum:
- a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
 - b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

1.8 MAINTENANCE SERVICE

1. Initial Maintenance Service for Trees and Shrubs: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until final acceptance
2. Initial Maintenance Service for Ground Cover and Plants: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until final acceptance

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Provide trees and shrubs of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.
- E. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

- F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

- 1. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.
- 2. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.

2.3 DECIDUOUS SHRUBS

- A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

- 1. Shrub sizes indicated are sizes after pruning.

2.4 CONIFEROUS EVERGREENS

- A. Form and Size: Specimen quality as described, symmetrically shaped coniferous evergreens.

2.5 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

- B. Form and Size: Specimen quality as described, symmetrically shaped broadleaf evergreens.

- 1. Shearing Designation: Natural, never sheared (N).

2.6 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1 and the following requirements:

- 1. As specified on the drawings.

2.7 PLANTS

- A. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

- B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

- C. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

- 1. Two-year plants with heavy, well-branched tops, with not less than 3 runners 18 inches or more in length, and with a vigorous well-developed root system.

2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

2.8 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.
 2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.9 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
 3. Provide lime in form of dolomitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.10 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.11 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb./1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

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2.12 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded hardwood, Ground or shredded bark, or Pine straw.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.13 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:
 - 1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
 - 2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
 - 3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, #12 wire.
 - 4. Hose Chafing Guards: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.
 - 5. Guy Cables: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
 - 6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.14 LANDSCAPE EDGINGS

- A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

2.15 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

2.16 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
 - 1. Ratio of Loose Compost to Topsoil by Volume: 1:3.
 - 2. Ratio of Loose Peat to Topsoil by Volume: 1:3.
 - 3. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:3.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.
- D. Lay out exterior plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING BED ESTABLISHMENT

- A. Loosen subgrade of planting beds to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.

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- B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, restore planting beds if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
 - 1. Excavate approximately two times as wide as ball diameter for stock.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.
- B. Subsoil removed from excavations may not be used as backfill.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 - 1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- B. Set balled and burlap stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades for shrubs, approximately 2" above finish grades for trees.
 - 1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- C. Set stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
 - 1. Carefully remove root ball from container without damaging root ball or plant.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

- D. Set fabric bag-grown stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
 - 1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- E. Set and support bare-root stock in center of pit or trench with trunk flare flush with adjacent finish grade. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots. Tamp final layer of backfill. Remove injured roots by cutting cleanly; do not break.
- F. Organic Mulching: Apply 3" average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 6 inches of trunks or stems.

3.6 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.

3.7 TREE STABILIZATION

- 1. Trunk Stabilization: as indicated on the details.

3.8 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants as indicated.
- B. Dig holes large enough to allow spreading of roots and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas.
 - 1. Organic Mulch: Apply 3" average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 EDGING INSTALLATION

- A. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions.

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3.11 PLANT MAINTENANCE

- A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.
- B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

3.12 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.13 DISPOSAL

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

SECTION 33 11 00 - WATER SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Excavation and backfill for water utilities.
- B. Meter pit and meter assembly, as required.
- C. Backflow prevention device(s), as required.
- D. Installation and testing of water lines.
- E. Removal and capping of existing water facilities as required.
- F. Other related work as may be required but not shown on the drawings or to meet local code.

1.2 QUALITY ASSURANCE

- A. All work is to conform to applicable city, county and/or state plumbing codes and the utilities involved.

1.3 MEASURE AND PAYMENT

- A. No separate payment shall be made for material or work under this section. All costs shall be included in the bid items to which the work pertains.

1.4 WARRANTIES/GUARANTEE

- A. For a period of one year from the date of issuance of the Final Certificate for Payment for the work, the Contractor shall furnish and install, without cost to the Owner, any and all work which, in the judgment of the Owner, proves defective in materials and/or workmanship.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water Line Products: All water line products shall conform to requirements of the Water Department with local jurisdiction.

2.2 MIXES

- A. Concrete (below ground where detailed); 3000 psi, Class A, air-entrained as per State Department of Transportation (unless otherwise stated by local jurisdiction having authority).
- B. Concrete (Surface of other where detailed); 3500 psi, Class A air-entrained as per State Department of Transportation (unless otherwise stated by local jurisdiction having authority).

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PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. See Section 315000.

3.2 INSTALLATION

- A. Installation and materials shall conform to requirements of the Water Department with local jurisdiction.
- B. Provide all necessary materials, anchors and thrust blocks, and incidentals to accomplish the work.
- C. The minimum depth of underground water service piping shall be not less than 24" from finished grade to top of pipe

3.3 REPAIR

- A. Unless otherwise specified or noted, all cutting of pavements, concrete floors, streets, walks, etc., - necessary for excavating - shall be include under this section, as shall be replaced or repaired to their original condition or better and to the entire satisfaction of the Owner's Representative and authorities having jurisdiction.

3.4 CLEAN-UP

- A. Unless otherwise specified or directed, all curbs, crosswalks, sidewalk material, rocks, or other unusable surface material shall be removed from the premises.
- B. Surplus earth excavation shall be placed in the site where directed by the Owner's Representative and spread in 6" layers or hauled away from the site. Unless specific arrangements are made, the earth shall remain the property of the Owner.

END OF SECTION 33 11 00

SECTION 33 41 00 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes gravity-flow, unpressurized storm drainage outside the building, with the following components:
 - 1. Precast concrete manholes.

1.3 DEFINITIONS

- A. PE: Polyethylene plastic.
- B. PVC: Polyvinyl chloride plastic.
- C. HDPE: High density polyethylene plastic

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Unpressurized, Drainage-Piping Pressure Rating: 4.5 PSI. Pipe joints shall be at least silt tight, unless otherwise indicated.

1.5 SUBMITTALS

Shop Drawings: For the following:

- 1. Manholes: Include plans, elevations, sections, details, and frames and covers.
- 2. Catch Basins. Include plans, elevations, sections, details, and frames, covers, and grates.
- 3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

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1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings DN 250 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 2. Corrugated PE Pipe and Fittings DN 250 to DN 1200: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 3. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.3 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76M, with bell-and-spigot or groove and tongue ends and gasketed joints with ASTM C 443M, rubber gaskets.
 1. Class III, Wall B.
 2. Class IV, Wall B.
 3. Class V, Wall B.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground unpressurized piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 1. For Concrete Pipes: ASTM C 443M, rubber.
 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Unpressurized-Type Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 PSI minimum, with 0.45 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, 60,000 PSI, deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 PSI minimum, with 0.58 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, 60,000 PSI, deformed steel.

2.6 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478M, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 4. Joint Sealant: ASTM C 990M, bitumen or butyl rubber.
 5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
 7. Pipe Connectors: ASTM C 923M, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inch minimum, unless otherwise indicated.
 2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.7 STORMWATER INLETS

- A. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions as indicated. Include heavy-duty frames and grates.
- B. Frames and Grates: As indicated.

2.8 STORMWATER DETENTION STRUCTURES

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A. Cast-in-Place Concrete, Stormwater Detention Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

2.9 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-3, screen opening 2-inch.

2.10 HDPE PIPE

A. HDPE pipe shall conform to the requirements of AASHTO M-294 and AASHTO MP7, TYPE S &D.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use unpressurized-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Unshielded flexible or rigid couplings for same or minor difference OD pipes.

B. Gravity-Flow, Unpressurized Sewer Piping: Use any of the following pipe materials for each size range: DN 100 and DN 150: Corrugated PE drainage pipe and fittings, silt tight soil tight couplings, and coupled joints. DN 200 to DN 300: Corrugated PE drainage pipe and fittings in DN 200 and DN 250 and corrugated PE pipe and fittings in DN 300, silt tight couplings, and coupled joints. DN 375: Corrugated PE pipe and fittings, silt tight couplings, and coupled joints. DN 450 to DN 900: Corrugated PE pipe and fittings, silt tight couplings, and coupled joints. DN 450 to DN 900: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout

take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- F. Install gravity-flow, unpressurized drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping **DN 150** and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with minimum cover.
 - 4. Install piping below frost line.
 - 5. Install corrugated steel piping according to ASTM A 798/A 798M.
 - 6. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
 - 7. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - 8. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - 9. Installation of HDPE pipe shall be in accordance with ASTM recommended practice D-2321, AASHTO section 30, or with Section 550 of the Georgia DOT Standard Specifications, Construction of Roads and Bridges.

3.4 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 22 Section "Common Work Results for Plumbing." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, unpressurized drainage piping according to the following:
 - 1. Join corrugated PE piping according to CPPA 100 and the following:
 - a. Use silt tight couplings for Type 1, silt tight joints.
 - 2. Join nonreinforced-concrete sewer piping according to ASTM C 14M and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 - 3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 - 4. Join dissimilar pipe materials with unpressurized type flexible or rigid couplings.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 - 1. Use light-duty, top-loading classification drains in **earth or unpaved foot-traffic** areas.
 - 2. Use medium-duty, top-loading classification drains in **paved foot-traffic** areas.
 - 3. Use heavy-duty, top-loading classification drains in **vehicle-traffic service** areas.
- B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops above finished surface elsewhere, unless otherwise indicated.

3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.

3.9 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 610 mm of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:

- a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924M.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

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SECTION 33 46 16 - SITE SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes subdrainage systems for the following:
 - 1. Plaza decks.
 - 2. Retaining walls.
 - 3. Landscaped areas.

1.2 DEFINITIONS

- A. HDPE: High-density polyethylene plastic.
- B. PE: Polyethylene plastic.
- C. PP: Polypropylene plastic.
- D. PS: Polystyrene plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Perforated-wall pipe and fittings.
 - 2. Solid-wall pipe and fittings.
 - 3. Drainage conduits.
 - 4. Drainage panels.
 - 5. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
 - 3. Couplings: Manufacturer's standard, band type.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.
- B. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

2.4 SPECIAL PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.
 - 1. Sleeve Materials:
 - a. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 2. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
 - 3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

- A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earthwork."

2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
 - 1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
 - 2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.3 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
- B. Header Piping:
 - 1. PE drainage tubing and fittings, couplings, and coupled joints.

3.4 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 - 1. At Grade in Earth: PVC cleanouts.

3.5 PLAZA DECK DRAINAGE INSTALLATION

- A. Horizontal Drainage Panel: Install between slab and floor cover. Place core on structural floor. Install panels to fit tightly around floor drains of building's storm drainage system. Provide stormwater access into floor drain.
 - 1. Install drainage piping as indicated in Part 3 "Piping Installation" Article for plaza deck subdrainage.

3.6 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

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- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.8 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Plaza Deck Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 1.0 percent.
 - 2. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
 - 3. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
 - 4. Lay perforated pipe with perforations down.
 - 5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.

3.9 PIPE JOINT CONSTRUCTION

- A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.10 CLEANOUT INSTALLATION

- A. Cleanouts for Retaining-Wall and Landscaping Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non-vehicular-traffic areas.
 - 3. In non-vehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.

3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system where shown.

3.12 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tapes directly over piping.
 - 1. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

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3.14 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

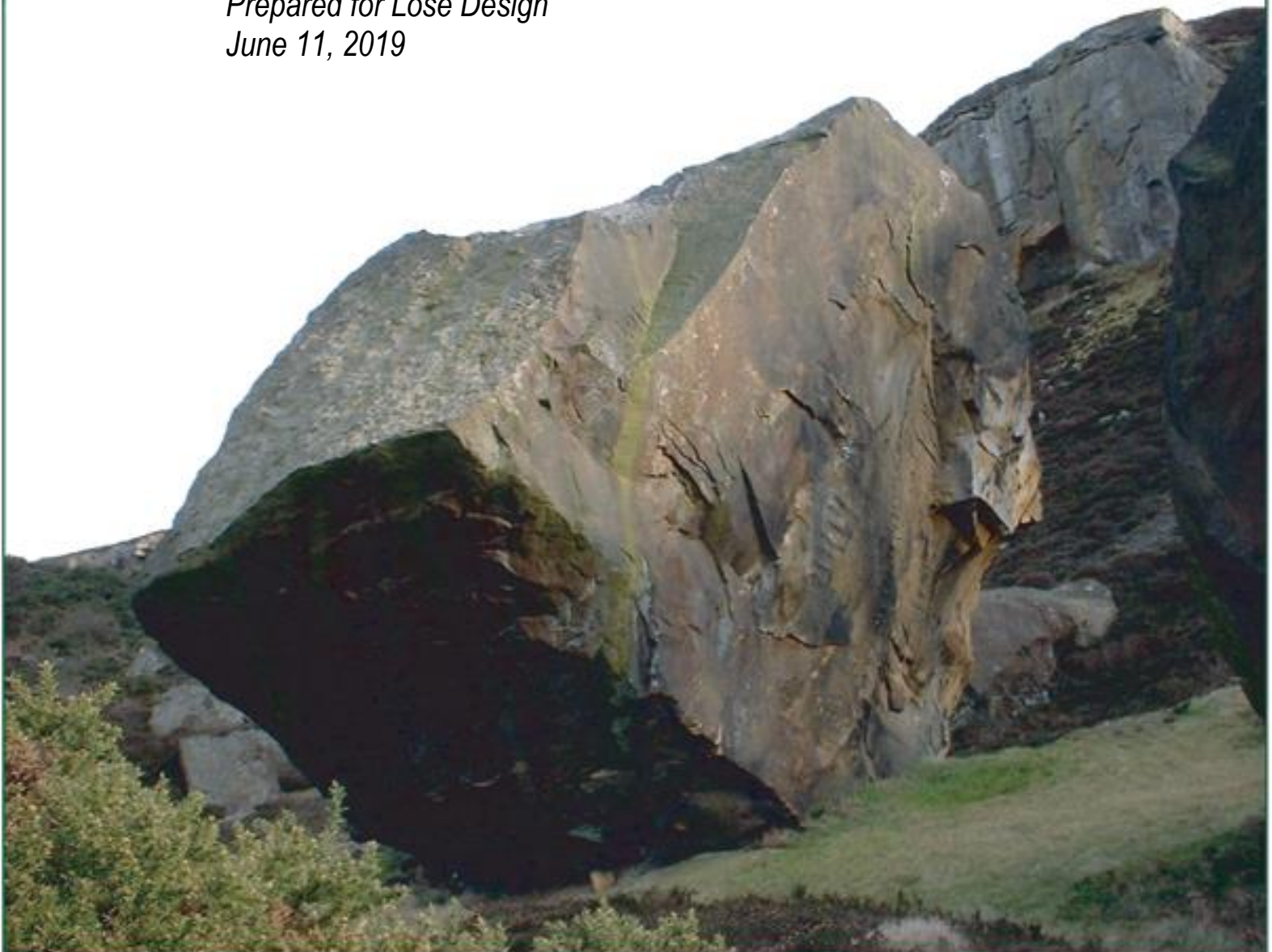
END OF SECTION 33 46 16



Report of Subsurface Exploration
and Geotechnical Engineering Evaluation

**Brookhaven Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190502.20**

*Prepared for Lose Design
June 11, 2019*



Mr. David Young, PLA, LEED® AP
Lose Design
220 W Crogan Street, Suite 100
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June 11, 2019

**Report of Subsurface Exploration and
Geotechnical Engineering Evaluation
Brookhaven Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190502.20**

Dear Mr. Young:

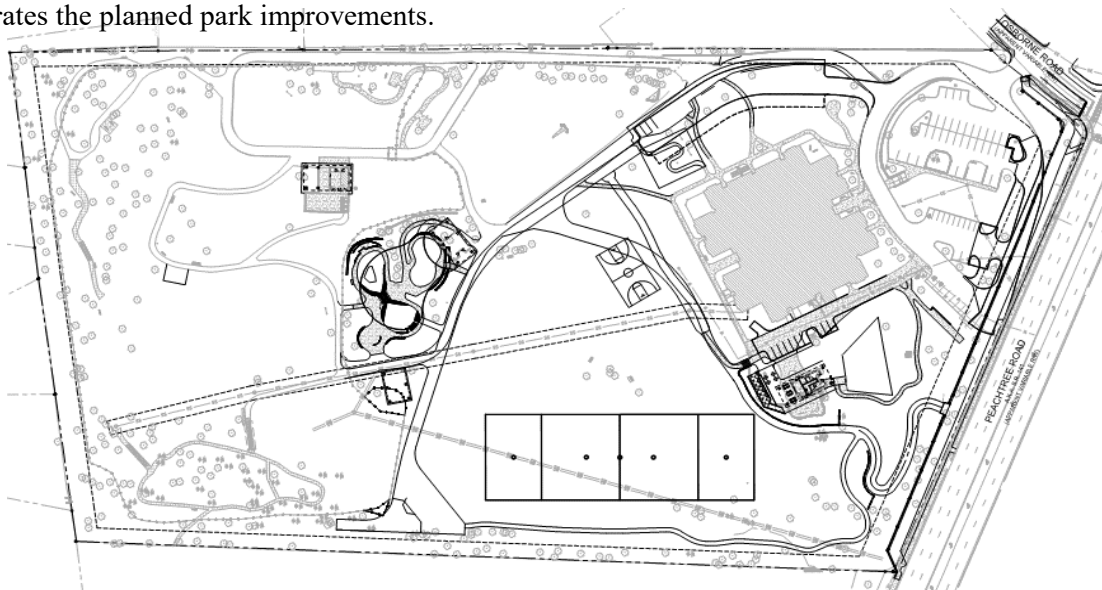
Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in our proposal number 23247.2 dated May 7, 2019.

Project Information

The project site is located at 4158 Peachtree Road NE in Brookhaven, Georgia. Figure 1 in the Appendix shows the approximate site location.

We understand that the park improvements will include the construction of three new buildings, two shade awnings, a basketball court addition, a site wall parallel to Peachtree Road, and infrastructure improvements. We anticipate that the buildings will be single-story masonry structures with a slab-on-grade floor system. Specifics regarding the planned construction, grading, or utility plans have not been provided to us at the time of this report. We have assumed that the maximum column load will be no greater than 75 kips and that the maximum wall load will not exceed 3 kips per foot.

The site is mostly grassed with asphalt parking, drives, and walking trails. The site plan excerpt below illustrates the planned park improvements.



Exploratory Procedures

The subsurface exploration consisted of 13 machine-drilled soil test borings performed at the approximate locations shown on Figure 2 included in the Appendix. The test borings were located in the field by Geo-Hydro by measuring angles and distances from existing site features. In general, the locations of the borings should be considered approximate.

Standard penetration testing, as provided for in ASTM D-1586, was performed at select intervals in the soil test borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D-488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records included in the Appendix.

Regional Geology

The project site is located in the Southern Piedmont Geologic Province of Georgia. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as “residual” soils. Residual soils near the ground surface that have experienced advanced weathering frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of 100 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process that the crystalline rock has undergone. The degree of weathering is most advanced at the ground surface, where fine-grained soil may be present. Conversely, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

Geologic conditions in parts of at the site have been modified by previous grading activities.

Soil Test Boring Summary

Starting at the ground surface, all borings except B-5 encountered topsoil ranging in thickness from about 1 to 12 inches. Measurements necessary for detailed quantity estimation were not part of our work scope. For budgeting purposes, we suggest using an average surface material thicknesses of 12 inches.

Beneath the surface materials, all borings except B-2, B-7, B-10B, and B-11 encountered fill materials extending to depths ranging from about 3 to 8 feet. The fill was classified as clayey sand, sandy silt, and silty sand with varying mica content. Standard penetration resistances recorded in the fill ranged from 5 to greater than 100 blows per foot. Based on our visual classification of the soil samples obtained during drilling, it is likely that the penetration resistance values in boring B-10A were amplified by the rock fragments and should not be considered indicative of the consistency of the fill material.

Beneath surface or fill materials, all of the borings encountered residual soils typical of the Piedmont region. The residual soils were classified as clayey sand, sandy silt, and silty sand with varying mica content. Standard penetration resistances in the residual soils ranged from 5 to 71 blows per foot.

Partially weathered rock was encountered in boring B-3 at a depth of about 12 feet. Partially weathered rock is locally defined as residual material having a standard penetration resistance of 100 blows per foot or greater.

At the time of drilling, groundwater was encountered in all borings except B-1, B-8, B-10A, and B-10B at depths ranging from 10 to 18 feet. For safety reasons the borings were backfilled upon completion. It should be noted that groundwater levels will fluctuate depending on yearly and seasonal rainfall variations and other factors, and may rise in the future.

For more detailed descriptions of subsurface conditions, please refer to the test boring records and hand auger log included in the Appendix.

Soil Test Boring Summary

Boring	Groundwater at Time of Drilling	Fill	Top of PWR	Auger Refusal	Boring Termination
	Depth (feet)	Depth (feet)	Depth (feet)	Depth (feet)	Depth (feet)
B-1	NE	3	NE	NE	20
B-2	12	NE	NE	NE	20
B-3	10	8	12	NE	20
B-4	11	3	NE	NE	20
B-5	15	8	NE	NE	20
B-6	14	3	NE	NE	20
B-7	18	NE	NE	NE	20
B-8	NE	3	NE	NE	20
B-9	18	3	NE	NE	20
B-10A	NE	3	NE	3	3
B-10B	NE	NE	NE	NE	20
B-11	16	NE	NE	NE	20
B-12	15	3	NE	NE	20

All Depths in this Summary Table are Approximate

NE – Not Encountered

PWR – Partially Weathered Rock

NA – Not Available. Boring Backfilled

Evaluations and Recommendations

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings represent a statistically small sampling of subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different from those indicated by the test borings. In these instances, adjustments to the design and construction may be necessary.

Geotechnical Considerations

The following geotechnical characteristics of the site should be taken into account for planning and design:

- All the borings except B-2, B-7, B-10B, and B-11 encountered previously placed fill materials extending to depths of about 3 to 8 feet. Variations within fill materials should be expected, and poor quality fill may be encountered intermediate of the areas directly explored. Remedial measures such as excavation and replacement of poor quality fill materials will be necessary. Thorough subgrade evaluations will be required during grading and construction.
- Boring B-3 encountered partially weathered rock at a depth of about 12 feet. Boring B-10A encountered conditions causing auger refusal at a depth of 3 feet. Boring B-10B was able to penetrate the materials causing auger refusal and was terminated at 20 feet. Within 10 feet of the ground surface, the borings encountered soils with generally favorable excavation characteristics that should be readily removable using conventional excavation equipment such as loaders and backhoes. No grading or utility plans have been provided to us at the time of this report. Depending on the layout of new underground utilities, partially weathered rock may be encountered during construction. If encountered, we expect that impact hammers will be necessary to remove partially weathered rock from trench excavations.
- At the time of drilling, groundwater was encountered in all borings except B-1, B-8, B-10A, and B-10B at depths ranging from about 10 to 18 feet. It is important to note that the groundwater level will fluctuate over time depending on local rainfall amounts and other factors and may be encountered at higher elevations. No site grading or utility plans have been provided to us at this time. Once a grading and utility plan have been developed, the potential effects of groundwater should be reevaluated.
- Contingent upon proper site preparation and thorough evaluation of the foundation excavations, it is our opinion that the proposed buildings can be supported using conventional shallow foundations and concrete slab-on-grade floors. For design purposes, we recommend an allowable soil bearing pressure of 2,500 psf or less.

- A site grading plan was not available at the time of this report and it is unclear what type of site retaining wall will be used along Peachtree Road. If mechanically stabilized earth (MSE) walls are considered, we recommend using select material (#57 stone, graded aggregate base, etc.) within the reinforced zone. Based on the results of the borings, we do not expect the on-site soils to meet the typical design criteria for backfill within the reinforced zone of MSE walls.
- Based on the results of the test borings and following the calculation procedure in the 2012 International Building Code (Chapter 20, ASCE 7-10), the *Site Class* for the site is D. The mapped and design spectral response accelerations are as follows: $S_s=0.193$, $S_1=0.091$, $S_{DS}=0.206$, $S_{D1}=0.146$.

The following sections provide recommendations regarding these issues and other geotechnical aspects of the project.

Existing Fill Materials

Existing fill materials were encountered all borings except B-2, B-7, B-10B, and B-11 extending to depths ranging from about 3 to 8 feet. There are several important facts that should be considered regarding existing fill materials and the limitations of subsurface exploration.

- The quality of existing fill materials can be highly variable, and test borings are often not able to detect all of the zones or layers of poor quality fill materials.
- Layers of poor quality fill materials that are less than about 2.5 to 5 feet thick may often remain undetected by soil test borings due to the discrete-interval sampling method used in this exploration.
- The interface between existing fill materials and the original ground surface may include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to the foundation and floor slab bearing surfaces, an organic layer might adversely affect support of footings and floor slabs. If such organic layers are encountered during construction, it may be necessary to “chase out” the organic layer by excavating the layer along with overlying soils.
- The construction budget should include funds for management of poor quality existing fill materials.
- Subsurface exploration is simply not capable of disclosing all conditions that may require remediation.

General Site Preparation

Topsoil, roots, pavements, demolition debris, and other deleterious materials should be removed from the proposed construction areas. All existing utilities should be excavated and removed unless they are to be incorporated into the new construction. Additionally, site clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive subgrade degradation. All excavations resulting from rerouting of underground utilities should be backfilled in accordance with the *Structural Fill* section of this report.

We recommend that areas to receive structural fill be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed with multiple passes in at least two directions using a fully loaded tandem axle dump truck weighing at least 18 tons. Proofrolling must be avoided within 10 feet of buildings and hardscapes to remain. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well compacted fill material placed in accordance with the *Structural Fill* section of this report. Proofrolling should be observed by Geo-Hydro to determine if remedial measures are necessary.

For budgeting purposes, we suggest considering that approximately 30 percent of the planned buildings, wall, pavement, and new hardscape areas will require undercutting and replacement extending to a depth of 3 feet below current grades. The suggested stabilization approach is intended only as a tool to estimate a cost associated with ground stabilization. Ground stabilization can be achieved by using geosynthetics, crushed stone, cement stabilization, etc. The need for, extent of, location, and optimal method of ground stabilization should be determined by Geo-Hydro at the time of construction based on actual site conditions. The extent and cost of ground stabilization may exceed the suggested budgetary estimate.

During site preparation, burn pits or trash pits may be encountered. On sites located in or near developed areas, this is not an unusual occurrence. All too frequently such buried material occurs in isolated areas which are not detected by the soil test borings. Any buried debris or trash found during the construction operation should be thoroughly excavated and removed from the site.

Excavation Characteristics

Boring B-3 encountered partially weathered rock at a depth of about 12 feet. Boring B-10A encountered conditions causing auger refusal at a depth of 3 feet, but boring B-10B was able to penetrate the materials causing auger refusal and was terminated at 20 feet. Within 10 feet of the ground surface, the borings encountered soils with generally favorable excavation characteristics that should be readily removable using conventional excavation equipment such as loaders and backhoes. However, it is important to note that the depth to rock or partially weathered rock may vary drastically over relatively short distances. It would not be unusual for rock pinnacles, boulders, or rock lenses to occur at higher elevations between or around some of the soil test borings.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

- **Mass Rock:** Material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent), and occupying an original volume of at least one cubic yard.
- **Trench Rock:** Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

The foregoing definitions are based on large equipment typically utilized for mass grading. Subsequent excavations for building foundations and underground utilities are often performed with smaller equipment such as rubber-tired backhoe/loaders or even mini-excavators. Small equipment will encounter difficult excavation during building construction and utility installation, and contractors will often request additional payment for mobilizing larger equipment than that which was anticipated during preparation of their construction bid. The amount of additional compensation, if any, and the minimum equipment size necessary to qualify for any additional compensation should be defined before the start of construction

Reuse of Excavated Materials

Based on the results of test boring and our observations, most of the existing fill materials and residual soils appear to be suitable for reuse as structural fill. Any excavated fill material containing organics, construction debris, or other debris in quantities that cannot be readily removed should be considered unsuitable for reuse. Geo-Hydro should observe the excavation of existing fill materials to evaluate their suitability for reuse. Soft, unstable fill soils free of deleterious materials may be reusable after routine moisture adjustment.

It is important to establish as part of the construction contract whether soils having elevated moisture content will be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

If generated during construction, partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering

judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

Structural Fill

Materials selected for use as structural fill should be free of organic debris, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Piedmont: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Piedmont: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt).

Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

It is possible that highly micaceous soils could be utilized as structural fill material. The use of such materials will require very close attention to quality control of moisture content and density. Additionally, it is our experience that highly micaceous soils tend to rut under rubber-tired vehicle traffic. Continuous maintenance of areas subjected to construction traffic is typically required until construction is completed.

Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but a maximum loose-lift thickness of 8 inches is generally recommended. The soil should be compacted by a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, above foundations, or behind retaining walls, we recommend the use of “wacker packers” or “Rammax” compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698). The upper 12 inches of floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. Additionally, the maximum dry density of structural fill should be no less than 90 pcf. Following Georgia DOT guidelines, the upper 12 inches of pavement subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density. Geo-Hydro should perform density tests during fill placement.

Groundwater

At the time of drilling, groundwater was encountered in all borings except B-1, B-8, B-10A, and B-10B at depths ranging from 10 to 18 feet. It is important to note that the groundwater level will fluctuate over time depending on local rainfall amounts and other factors and may be encountered at higher elevations. No grading or utility plans have been provided to us at this time. Once a grading and utility plan have been developed, the potential effects of groundwater should be reevaluated. Regardless of the groundwater conditions encountered in the borings, waterproofing and subsurface drainage is required for all retaining walls and building walls below grade.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils at the site are Type B as defined in 29 CFR 1926 Subpart P. This dictates that temporary construction slopes be no steeper than 1H:1V for excavation depths of 20 feet or less. *Temporary excavation slopes in fill materials or below the groundwater level must be no steeper than 1.5H:1V.* Temporary construction slopes should be closely observed on a daily basis by the contractor's "competent person" for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Formal analysis of slope stability was beyond the scope of work for this project. Based on our experience, permanent cut or fill slopes should be no steeper than 2H:1V to maintain long term stability and to provide ease of maintenance. The crest or toe of cut or fill slopes should be no closer than 10 feet to any foundation. The crest or toe should be no closer than 5 feet to the edge of any pavements. Erosion protection of slopes during construction and during establishment of vegetation should be considered an essential part of construction.

Earth Pressure (Cast-in-Place Structures)

Three earth pressure conditions are generally considered for retaining wall design: "at rest", "active", and "passive" stress conditions. Retaining walls which are rigidly restrained at the top and will be essentially unable to rotate under the action of earth pressure (such loading dock walls) should be designed for "at rest" conditions. Retaining walls which can move outward at the top as much as 0.5 percent of the wall height (such as free-standing walls) should be designed for "active" conditions. For the evaluation of the resistance of soil to lateral loads the "passive" earth pressure must be calculated. It should be noted that full development of passive pressure requires deflections toward the soil mass on the order of 1.0 percent to 4.0 percent of total wall height.

Earth pressure may be evaluated using the following equation:

$$p_h = K (D_w Z + q_s) + W_w(Z-d)$$

where: p_h = horizontal earth pressure at any depth below the ground surface (Z).

W_w = unit weight of water

Z = depth to any point below the ground surface

d = depth to groundwater surface

D_w = wet unit weight of the soil backfill (depending on borrow sources). The wet unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level, D_w must be the buoyant weight.

q_s = uniform surcharge load (add equivalent uniform surcharge to account for construction equipment loads)

K = earth pressure coefficient as follows:

<u>Earth Pressure Condition</u>	<u>Coefficient</u>
At Rest (K_o)	0.5
Active (K_a)	0.33
Passive (K_p)	3.0

The groundwater term, $W_w(Z-d)$, should be used if no drainage system is incorporated behind retaining walls. If a drainage system is included which will not allow the development of any water pressure behind the wall, then the groundwater term may be omitted. The development of excessive water pressure is a common cause of retaining wall failures. Drainage systems should be carefully designed to ensure that long term permanent drainage is accomplished.

The above design recommendations are based on the following assumptions:

- Horizontal backfill
- 95 percent standard Proctor compactive effort on backfill (ASTM D698)
- No safety factor is included

For convenience, equivalent fluid densities are frequently used for the calculation of lateral earth pressures. For "at rest" stress conditions, an equivalent fluid density of 63 pcf may be used. For the "active" state of stress an equivalent fluid density of 42 pcf may be used. These equivalent fluid densities are based on the assumptions that drainage behind the retaining wall will allow *no* development of hydrostatic pressure; that native sandy silts or silty sands will be used as backfill; that the backfill soils will be compacted to 95 percent of standard Proctor maximum dry density; that backfill will be horizontal; and that no surcharge loads will be applied.

For analysis of sliding resistance of the base of a cast-in-place concrete retaining wall, the coefficient of friction may be taken as 0.4 for the soils at the project site. This is an ultimate value, and an adequate factor of safety should be used in design. The force which resists base sliding is calculated by

multiplying the normal force on the base by the coefficient of friction. Full development of the frictional force could require deflection of the base of roughly 0.1 to 0.3 inches.

Foundation Design

At the time of this report, no foundations loads were available for the new buildings. The following recommendations are based on an assumed maximum column load of 75 kips and a maximum wall load of 3 kips per lineal foot. No loading for the site wall has been provided at the time of this report. If actual loads are greater than our assumed limits, please let us know so we can confirm that the allowable bearing pressure is still applicable.

After general site preparation and site grading have been completed in accordance with the recommendations of this report, it is our opinion that the proposed buildings and site wall can be supported using conventional shallow foundations. We recommend that footings be designed for an allowable soil bearing pressure of 2,500 psf. In addition, we recommend a minimum width of 24 inches for column footings and 18 inches for continuous wall footings to prevent general bearing capacity failure. Footings should bear at a minimum depth of 18 inches below the prevailing exterior ground surface elevation to avoid potential problems due to frost heave.

The recommended allowable soil bearing pressure is based on an estimated maximum total foundation settlement no greater than approximately 1 inch, with anticipated differential settlement between adjacent columns not exceeding about ½ inch. If the architect or structural engineer determine that the estimated total or differential settlement cannot be accommodated by the proposed structure, please contact us.

Foundation bearing surface evaluations should be performed in all footing excavations prior to placement of reinforcing steel. These evaluations should be performed by Geo-Hydro to confirm that the design allowable soil bearing pressure is available. Foundation bearing surface evaluations should be performed using a combination of visual observation, hand augering, and portable dynamic cone penetrometer testing (ASTM STP-399).

Because of natural variation, it is possible that some of the soils at the project site may have an allowable bearing pressure less than the recommended design value. Likewise, existing fill materials are highly variable, and may have an allowable bearing pressure less than the recommended design value. Therefore, foundation bearing surface evaluations will be critical to aid in the identification and remediation of these situations.

Remedial measures should be based on actual field conditions. However, in most cases we expect the use of the stone replacement technique to be the primary remedial measure. Stone replacement involves the removal of soft or loose soils, and replacement with well-compacted graded aggregate base (GAB) meeting Georgia Department of Transportation specifications for gradation. Stone replacement is generally performed to depths ranging from a few inches to as much as 2 times the footing width, depending on the actual conditions. For budgeting purposes, we suggest considering a contingency to treat approximately 30 percent of the foundation excavations using stone replacement extending to a

depth of 3 feet below bearing elevation. The actual quantity of stone replacement will be different and may exceed the suggested estimate.

Seismic Design

Based on the results of the test borings and following the calculation procedure in the 2012 International Building Code (Chapter 20, ASCE 7-10), the *Site Class* for the site is D. The mapped and design spectral response accelerations are as follows: $SS=0.193$, $S1=0.091$, $SDS=0.206$, $SD1=0.146$.

Based on the information obtained from the soil test borings, it is our opinion that the potential for liquefaction of the residual soils at the site due to earthquake activity is relatively low.

Floor Slab Subgrade Preparation

The soil subgrade in the area of concrete slab-on-grade support is often disturbed during foundation excavation, plumbing installation, and superstructure construction. We recommend that the floor slab subgrade be evaluated by Geo-Hydro immediately prior to beginning floor slab construction. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well-compacted fill material placed in accordance with the *Structural Fill* section of this report or with well-compacted graded aggregate base (GAB).

Assuming that the top 12 inches of floor slab subgrade soils are compacted to at least 98 percent of the standard Proctor maximum dry density, we recommend that a modulus of subgrade reaction of 120 pci be used for design.

Moisture Control for Concrete Slabs

To prevent the capillary rise of groundwater from adversely affecting the concrete slab-on-grade floor, we recommend that slab-on-grade floors be underlain by a minimum 4-inch thickness of open-graded stone. Use of #57 crushed stone meeting Georgia DOT specifications for gradation is suggested. The stone must be covered by a vapor retarder. We suggest polyethylene sheeting at least 10 mils thick as a minimum vapor retarder.

In areas where floor slabs may be subjected to vehicular traffic including forklifts, trucks, or other relatively heavy wheeled equipment, we recommend that slab-on-grade floors be underlain by a minimum 5-inch thickness of graded aggregate base (GAB) compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557). The GAB must be covered by a vapor retarder as suggested above.

Flexible Pavement Design

Based on our experience with similar projects, assuming standard pavement design parameters, and contingent upon proper pavement subgrade preparation, we recommend the following pavement sections:

Entrance/Exit Driveways, Main Drive Lanes, and Truck Traffic Areas

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave	2
Asphaltic Concrete 19mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D-698)	12

Automobile Parking and Automobile Traffic Only

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D-698)	12

A concrete thickness of 7 inches is recommended for the approach and collection zone in front of the dumpster and in designated truck turn-around areas. Please refer to the *Concrete Pavement* section of this report for concrete pavement recommendations.

Similar to floor slab subgrades, pavement subgrades generally deteriorate due to construction activities between the time of general site preparation and pavement construction. The top 12 inches of pavement subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Scarification and moisture adjustment will likely be required to achieve the recommended subgrade compaction level. Allowances for pavement subgrade preparation should be considered for budgeting and scheduling.

GAB must be compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557).

All pavement construction should be performed in general accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications, will be critical to the performance of the constructed pavement.

Concrete Pavement

A rigid portland cement concrete pavement may be considered. Although usually more costly, a portland cement concrete pavement is typically more durable and requires less maintenance throughout the life cycle of the facility. We recommend concrete thicknesses of 5 inches in automobile parking areas and 6 inches in driveways, traffic lanes, and truck traffic areas.

A concrete thickness of 7 inches is recommended for the approach and collection zone in front of the dumpster and in designated truck turn-around areas.

A 600-psi flexural strength concrete mix (approximately 4,500 psi compressive strength) with 4 to 6 percent air entrainment should be used. The concrete pavement should be underlain by no less than 5 inches of compacted graded aggregate base (GAB). GAB should be compacted to at least 100 percent the modified Proctor maximum dry density (ASTM D1557). The top 12 inches of soil subgrade should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698).

The concrete pavement may be designed as a “plain concrete pavement” with no reinforcing steel, or reinforcing steel may be used at joints. Construction joints and other design details should be in accordance with guidelines provided by the Portland Cement Association and the American Concrete Institute.

In general, all pavement construction should be in accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications will be critical to the performance of the constructed pavement.

Pavement Design Limitations

The pavement sections discussed above are based on our experience with similar type developments. After traffic information has been developed, we recommend that you allow us to review the traffic data and revise our recommendations as necessary.

Pavement Materials Testing

To aid in verifying that the pavement system is installed in general accordance with the design considerations, the following materials testing services are recommended:

- Density testing of subgrade materials.
- Proofrolling of pavement subgrade materials immediately prior to placement of graded aggregate base (GAB). This proofrolling should be performed the same day GAB is installed.
- Density testing of GAB and verification of GAB thickness. In-place density should be verified using the sand cone method (ASTM D1556).
- Coring of the pavement to verify thickness and density (asphalt pavement only).
- Preparation and testing of beams and cylinders for flexural and compressive strength testing (portland cement concrete only). The total number of test specimens required will depend on the number of concrete placement events necessary to construct the pavement.

* * * * *



We appreciate the opportunity to serve as your geotechnical consultant for this project and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.



John T. Redding, E.I.T.
Staff Engineer
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Luis E. Babler, P.E.
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JTR/LEB/190502.20 Brookhaven Park Improvements

APPENDIX

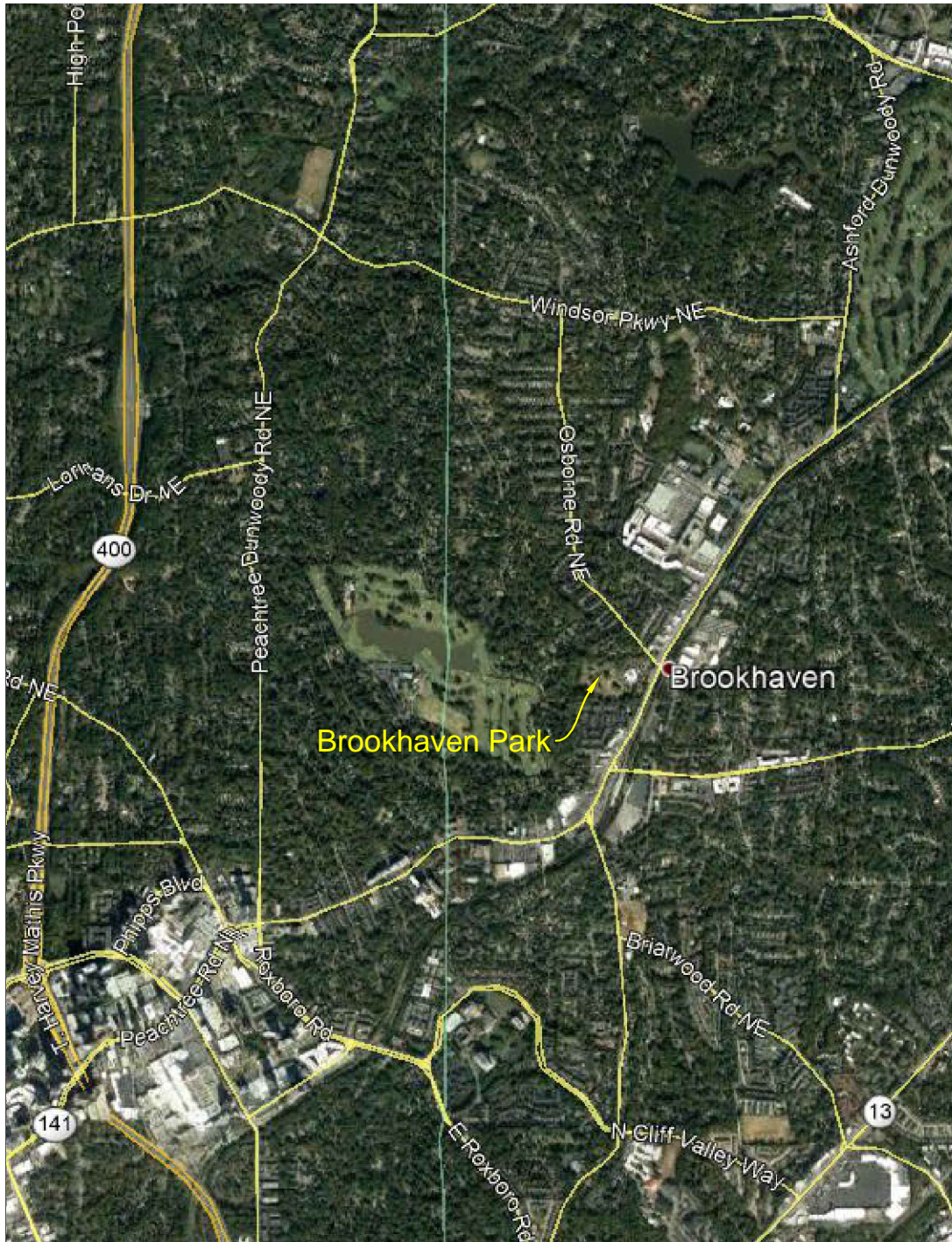
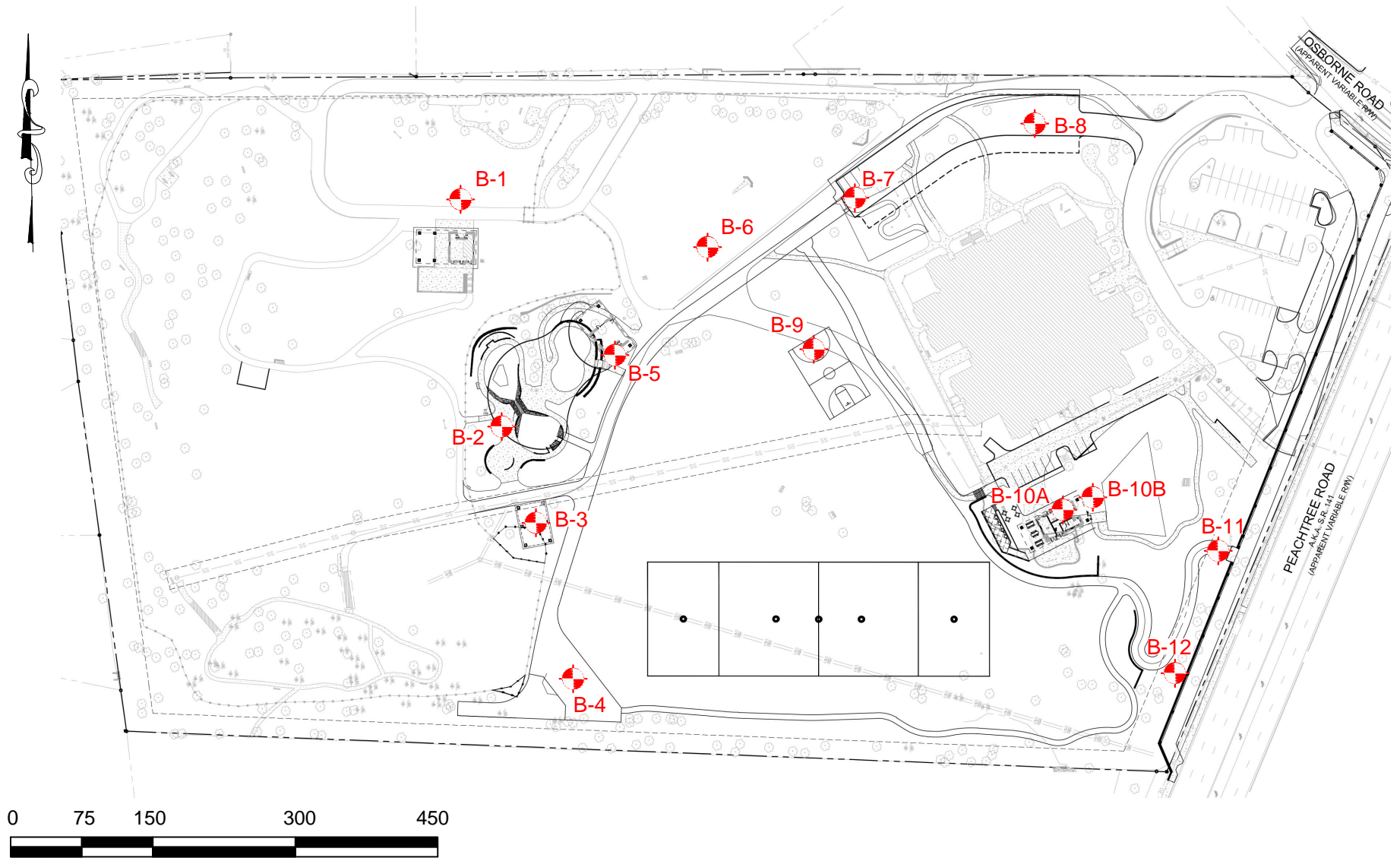


Figure 1: Site Location Plan

Brookhaven Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190502.20



Approximate Scale: 1"=150'

LEGEND:  Soil Test Boring

Figure 2: Boring Location Plan

Brookhaven Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190502.20

Symbols and Nomenclature

Symbols

█	Thin-walled tube (TWT) sample recovered
▢	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2"	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
▼	Water level at least 24 hours after drilling
▽	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results

	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense
	Number of Blows, N	Approximate Consistency
Silts and Clays	0-1	very soft
	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

B-1

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: Not Encountered	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil Approximately 1 inch																
				Gray and red-brown silty fine sand (SM) with rock fragments (FILL)*	50/3"															
	5			Stiff to very stiff tan and red-brown micaceous fine sandy silt (ML) (RESIDUUM)	16															
					17															
	10				12															
				Loose brown and tan silty fine sand (SM)	8															
	15				8															
	20			Boring Terminated at 20 feet	8															
	25																			

Remarks: *Penetration resistance not considered representative due to rocks in fill

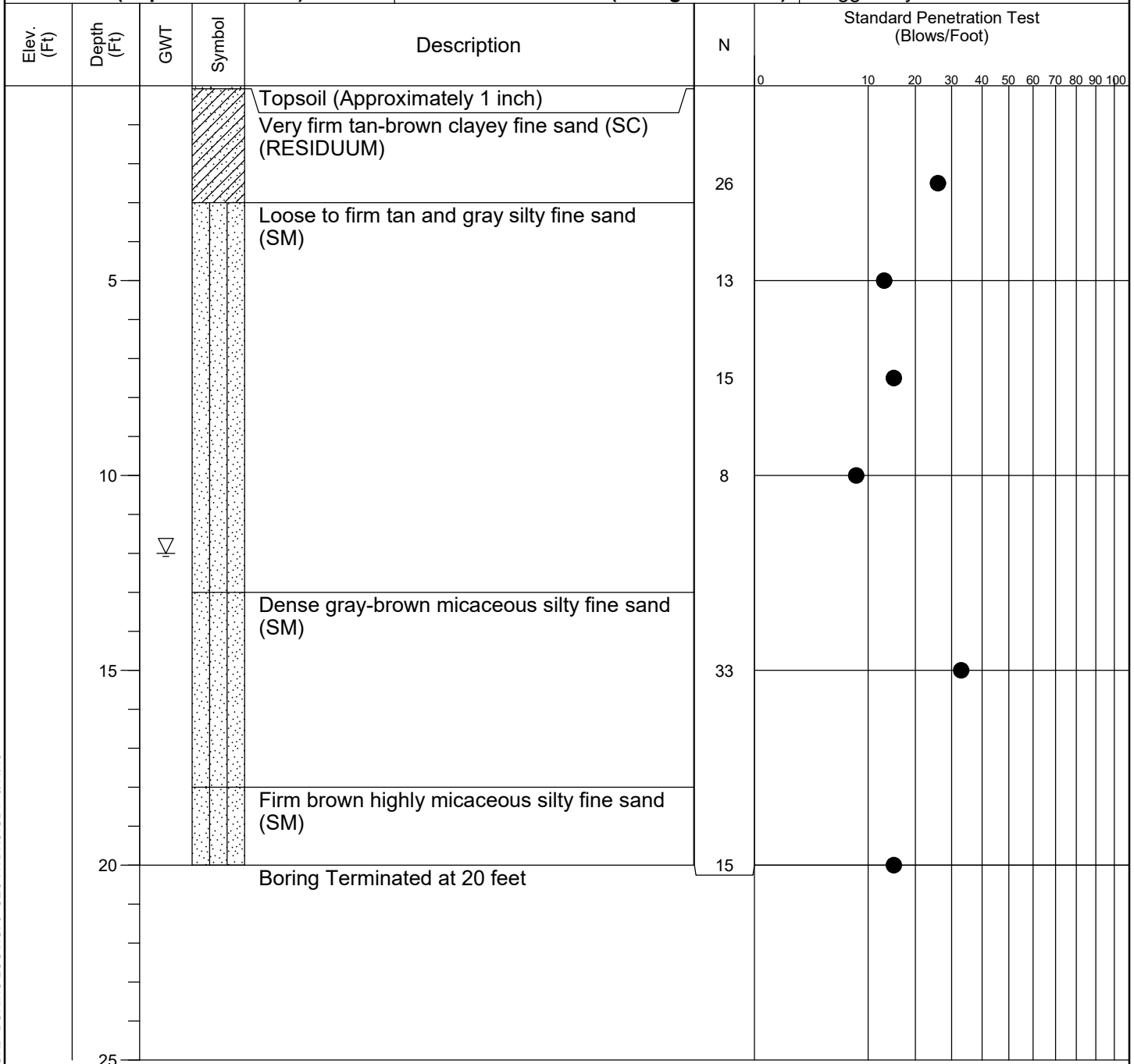
TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-2

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 12 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: JR



TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

Remarks:

B-3

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 10 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: JR

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 12 inches)																
				Dense brown silty fine sand (SM) (FILL)	31															
				Loose brown slightly micaceous silty fine sand (SM) (FILL)	8															
	5			Loose brown slightly micaceous silty fine sand (SM) (FILL)	7															
				Firm gray and white micaceous silty fine sand (SM) (RESIDUUM)	20															
	10			Firm gray and white micaceous silty fine sand (SM) (RESIDUUM)																
				Partially weathered rock sampled as gray micaceous silty fine sand (SM)	50/6"															
	15			Partially weathered rock sampled as gray micaceous silty fine sand (SM)																
	20			Boring Terminated at 20 feet	50/0"															
	25																			

Remarks:

B-4

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 11 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)															
						0	10	20	30	40	50	60	70	80	90	100					
				Topsoil (Approximately 1 inch)																	
				Loose red-brown and gray clayey fine sand (SC) (FILL)	9																
	5			Firm to stiff gray and light brown fine sandy silt (ML) (RESIDUUM)	7																
				Firm brown, white, tan, and gray silty fine sand (SM)	9																
	10			Firm brown, white, tan, and gray silty fine sand (SM)	13																
	15			Firm brown, white, tan, and gray silty fine sand (SM)	17																
	20			Very dense brown, white, tan, and gray silty fine sand (SM)	77																
				Boring Terminated at 20 feet																	

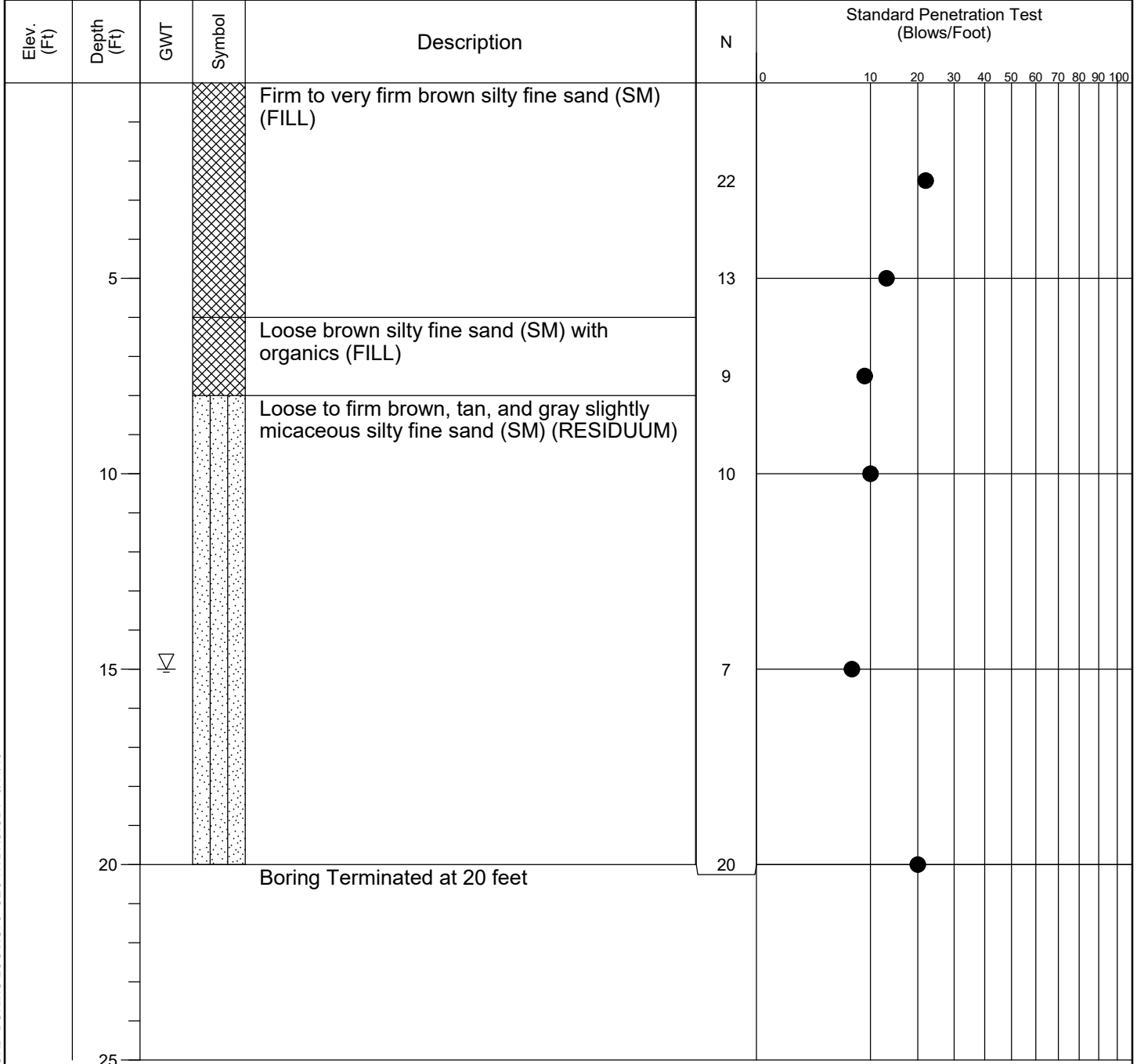
Remarks:

B-5

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/30/19
Method: HSA- ASTM D1586	GWT at Drilling: 15 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA



Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-6

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 14 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 2 inches)																
				Firm brown fine sandy silt (ML) (FILL)																
	5			Firm brown and tan fine sandy silt (ML) (RESIDUUM)	5		●													
	6			Firm brown and tan fine sandy silt (ML) (RESIDUUM)	6		●													
	10			Loose to firm gray, tan, and brown silty fine sand (SM)	10			●												
	11			Loose to firm gray, tan, and brown silty fine sand (SM)	11			●												
	15			Loose to firm gray, tan, and brown silty fine sand (SM)	16			●												
	20			Very firm gray and tan silty fine sand (SM)	28				●											
	20			Boring Terminated at 20 feet	28															

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-7

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/30/19
Method: HSA- ASTM D1586	GWT at Drilling: 18 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)															
						0	10	20	30	40	50	60	70	80	90	100					
				Topsoil (Approximately 2 inches) Stiff to very stiff red, tan, brown, and gray fine sandy silty (ML) (RESIDUUM)																	
	5				21																
	10				11																
	15				9																
	20			Boring Terminated at 20 feet	19																

Remarks:

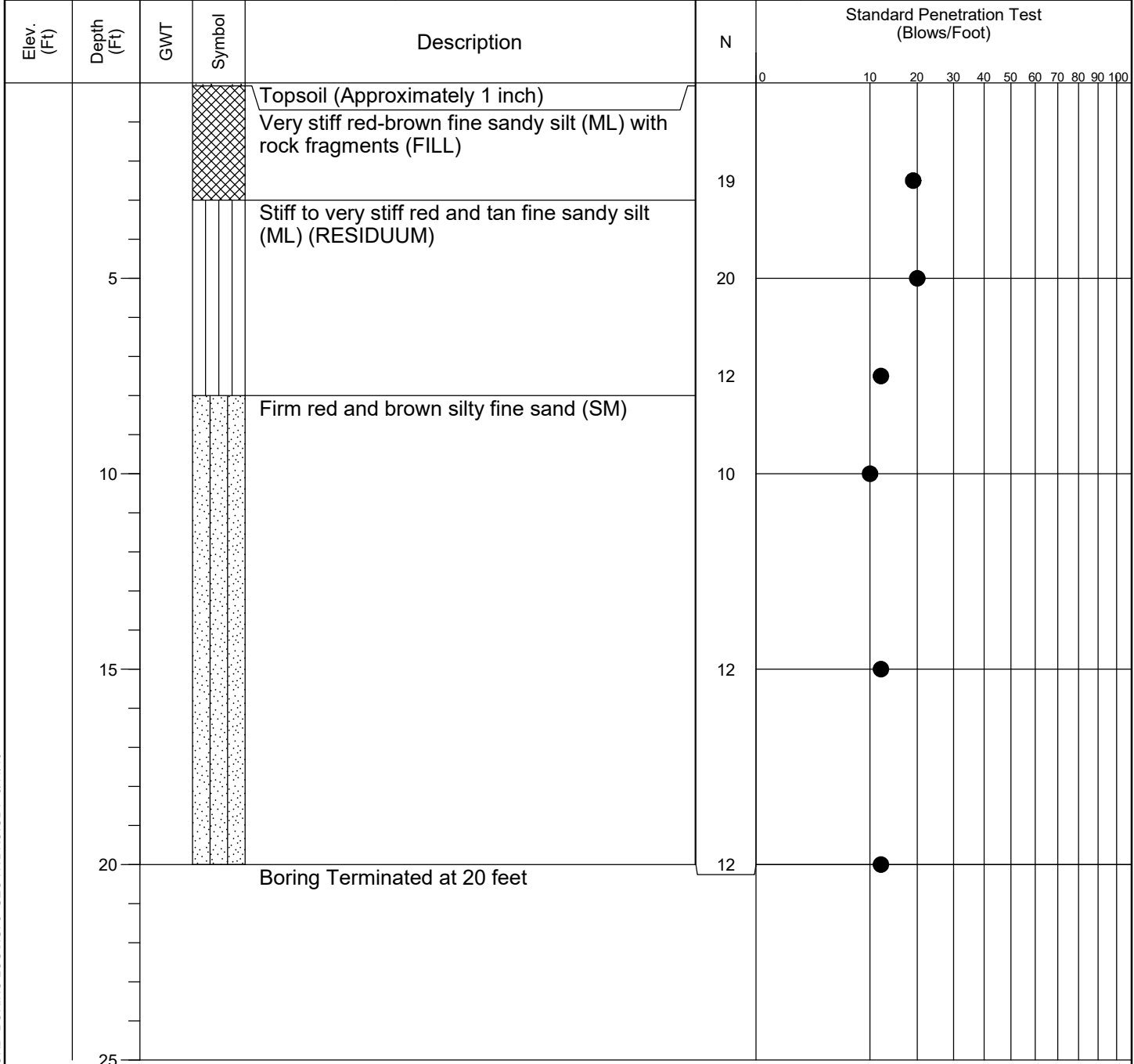
TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-8

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: Not Encountered	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA



Remarks:

B-9

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/30/19
Method: HSA- ASTM D1586	GWT at Drilling: 18 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 1 inch)																
				Firm red and brown silty fine sand (FILL)																
	5			Loose to firm red-brown to gray and tan silty fine sand (SM) (RESIDUUM)	12															
					12															
					8															
	10				9															
					16															
	15				16															
				Dense tan silty fine sand (SM)																
	20			Boring Terminated at 20 feet	35															
	25																			

Remarks:

B-10A

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/30/19
Method: HSA- ASTM D1586	GWT at Drilling: Not Encountered	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 1 inch) No sample recovered due to rock fragments in the fill*																
				Auger Refusal at 3 feet	50/0" 50/0"															
	5																			
	10																			
	15																			
	20																			
	25																			

Remarks: *Penetration resistance not considered representative due to rocks in fill

B-10B

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/30/19
Method: HSA- ASTM D1586	GWT at Drilling: Not Encountered	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)															
						0	10	20	30	40	50	60	70	80	90	100					
				Topsoil (Approximately 1 inch) Auger boring only cuttings classified as red-brown silty fine sand (SM)																	
	5			Loose to firm red-tan, tan, and gray slightly micaceous silty fine sand (SM) (RESIDUUM)																	
	10				10																
	15				12																
	20			Boring Terminated at 20 feet	9																
	25				8																

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-11

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 16 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 1 inch)																
				Stiff to very stiff red and red-brown fine sandy silt (ML) (RESIDUUM)	25															
	5			Stiff light brown fine sandy silt (ML) with quartz fragments	13															
				Stiff tan and red to gray fine sandy silt (ML)	12															
	10				11															
	15	▽			9															
	20			Boring Terminated at 20 feet	11															
	25																			

Remarks:

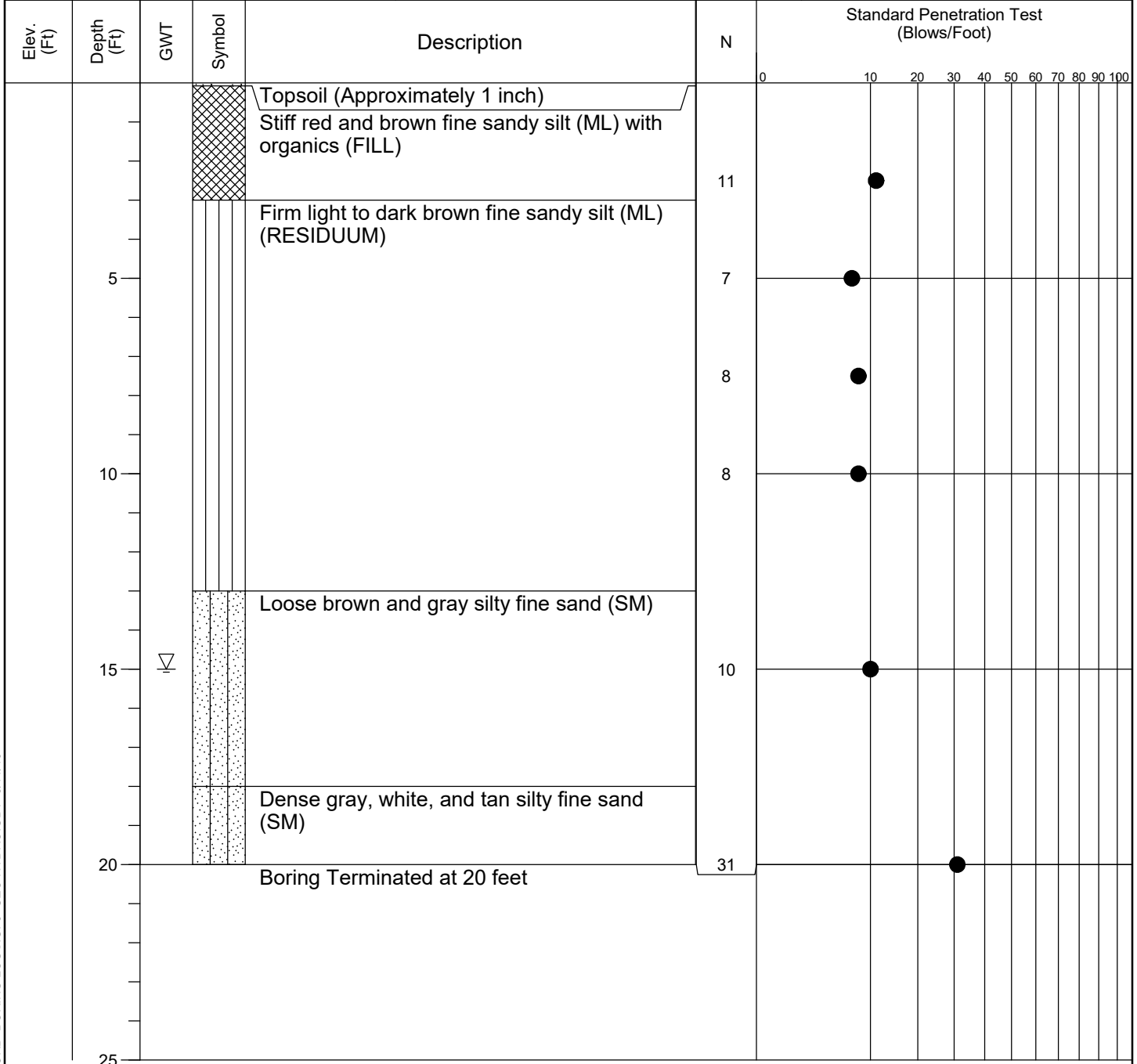
TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19

B-12

Test Boring Record



Project: Brookhaven Park Improvements		Project No: 190502.20
Location: Brookhaven, Georgia		Date: 5/29/19
Method: HSA- ASTM D1586	GWT at Drilling: 15 feet	G.S. Elev:
Driller: SD(Rope and Cathead)	GWT at 24 hrs: N/A (Boring Backfilled)	Logged By: CJA



Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 6/11/19