McLain High School

Technical Specifications

November 10, 2023

TULSA
PUBLIC SCHOOLS

Owner:

Tulsa Public Schools
Independent School District No. Three
Of Tulsa County
3027 South New Haven
Tulsa, Oklahoma 74114

Architect:

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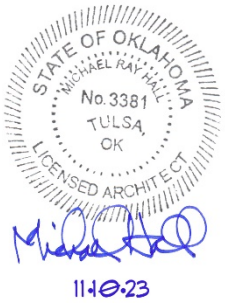
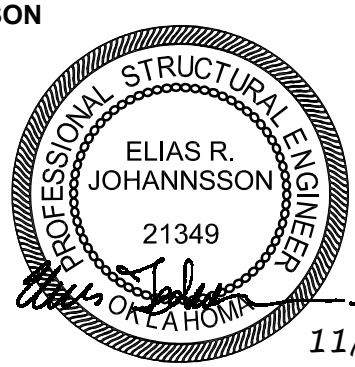
GH2 ARCHITECTS
Design. Service. Solutions.

SECTION 00 0107
SEALS PAGE

ARCHITECT: MICHAEL HALL



STRUCTURAL ENGINEER: ELLI JOHANNSSON



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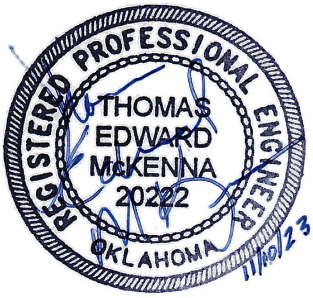

CIVIL ENGINEER: NICOLE WATTS

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SECTION 000110
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END OF SECTION 000110

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SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

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

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

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

1.02 RELATED REQUIREMENTS

A. Section 012100 - Allowances: Payment procedures relating to allowances.

B. Section 012200 - Unit Prices: Payment and modification procedures relating to unit prices.

C. Section 017800 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

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

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

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

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

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

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

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

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

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

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

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

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

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

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

I. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 013000.
   2. Construction progress schedule, revised and current as specified in Section 013000.
   3. Current construction photographs specified in Section 013000.
   4. Partial release of liens from major subcontractors and vendors.
   5. Affidavits attesting to off-site stored products.

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

1.05 MODIFICATION PROCEDURES

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

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

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

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

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

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

G. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:

a. Origin and date of claim.
b. Dates and times work was performed, and by whom.
c. Time records and wage rates paid.
d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

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

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

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

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

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012000

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 012100 - Allowances, for cash allowances affecting this section.

B. Section 012200 - Unit Prices, for additional unit price requirements.

C. Section 012300 - Alternates, for product alternatives affecting this section.

D. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

E. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

F. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

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

1.04 REFERENCE STANDARDS

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

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

B. A Substitution Request for specified installer constitutes a representation that the submitter:

1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

D. Where "basis of design" or named products are specified, alternate equivalent manufacturers and materials may be proposed provided they are of equal quality and appearance to that specified, in the opinion of the Architect. Contractor shall provide an item-by-item and side-by-side comparison of proposed substitutions. Include all deviations and / or differences between proposed product and specified product. Include side-by-side images to indicate differences in appearance. Substitution forms without this information or incomplete proposals will be returned without review. Contractor to coordinate alternate substrate and backing requirements that may be required and compatibility with other adjacent materials and systems.

E. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
         2) Owner's, Architect's, and Contractor's names.
         3) Additional information as required to facilitate review.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
         2) Indication of whether the substitution is for cause or convenience.
         3) Issue date.
         4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
         5) Description of Substitution.
         6) Reason why the specified item cannot be provided.
         7) Differences between proposed substitution and specified item.
         8) Description of how proposed substitution affects other parts of work.
      c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
         1) Physical characteristics.
         2) In-service performance.
         3) Expected durability.
         4) Visual effect.
         5) Sustainable design features.
         6) Warranties.
         7) Other salient features and requirements.
         8) Include, as appropriate or requested, the following types of documentation:
            (a) Product Data:
            (b) Samples.
            (c) Certificates, test, reports or similar qualification data.
            (d) Drawings, when required to show impact on adjacent construction elements.
            (e) Photos or images.
            (f) Provide clear, legible, high resolution electronic documents.
               (1) Blurry, distorted, or miss-aligned text or images, or low-quality scans of printed materials will not be reviewed.
      d. Impact of Substitution:
         1) Savings to Owner for accepting substitution.

2) Change to Contract Time due to accepting substitution.

F. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

G. Substitutions will not be considered when acceptance will require revisions to Contract Documents.

H. Substitution requests that do not follow all specified procedures or contain all specified requirements and information will be returned without review.
   1. All substitution requests must be reviewed by architect.
   2. Vendor correspondence or solicitation to engineers or architect's consultants does not constitute a substitution request.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Architect will consider requests for substitutions only within 30 days after date of Agreement.

B. Submit request for Substitution for Cause immedately upon discovery of need for substitution, but not later than 15 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 15 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
      b. Other construction by Owner.
      c. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record.

END OF SECTION 012500

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Advancement of Construction Technology

Print Form

SUBSTITUTION REQUEST

(During The Bidding Phase)

Project: _____ Substitution Request Nbr: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted By: _____

Signed By: _____

Firm: _____

Address: _____ Telephone: _____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.

☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed By: _____ Date: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports

September 1996
CSI Form 1.5C

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Progress meetings.

E. Construction progress schedule.

F. Progress photographs.

G. Time-lapse video documentation.

H. Coordination drawings.

I. Submittals for review, information, and project closeout.

J. Number of copies of submittals.

K. Requests for Interpretation (RFI) procedures.

L. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: General product requirements.

B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

A. AIA G716 - Request for Information 2004.

B. AIA G810 - Transmittal Letter 2001.

C. CSI/CSC Form 12.1A - Submittal Transmittal Current Edition.

D. CSI/CSC Form 13.2A - Request for Information Current Edition.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

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

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.

C. Submittal Service: The selected service is:
   1. Mutually agreed upon by Architect, Contractor and Owner.

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

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

3.02 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Designation of personnel representing the parties to Contract.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with copy to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Special consultants.
   5. Contractor's superintendent.
   6. Major subcontractors.
   7. Owner's Vendors, as appropriate for coordination.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of RFIs log and status of responses.
   7. Review of off-site fabrication and delivery schedules.
   8. Maintenance of progress schedule.
   9. Corrective measures to regain projected schedules.
   10. Planned progress during succeeding work period.
   11. Coordination of projected progress.
   12. Maintenance of quality and work standards.
   13. Effect of proposed changes on progress schedule and coordination.
   14. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.05 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

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

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by photographer, acceptable to Architect.
   1. Contrator may take photos. Professional photography is not required.

E. In addition to periodic, recurring views, take photographs of each of the following events:

1. Completion of site clearing.
2. Excavations in progress.
3. Foundations in progress and upon completion.
4. Structural framing in progress and upon completion.
5. Enclosure of building, upon completion.
6. Final completion, minimum of ten (10) photos.

F. Take photographs as evidence of existing project conditions as follows:
1. Interior views: Existing items to be salvaged.
2. Exterior views: Existing structures or items to remain.

G. Views:
1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
2. Consult with Architect for instructions on views required.
3. Provide factual presentation.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.06 PROGRESS VIDEO DOCUMENTATION

A. Provide time-lapse video documentation throughout entire duration of project.
1. Provide a minimum of three vantage points.
2. Use firm, methods and systems as approved by Owner.

3.07 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.08 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Owner.
a. Use AIA G716 - Request for Information .
b. Use CSI/CSC Form 13.2A - Request for Interpretation.
3. Prepare using an electronic version of the form appended to this section.

4. Prepare using software provided by the Electronic Document Submittal Service.
5. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 016000 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Remove improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.09 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Coordinate with Contractor's construction schedule and schedule of values.
   2. Format schedule to allow tracking of status of submittals throughout duration of construction.
   3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.10 SUBMITTALS FOR REVIEW

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

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

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

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

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

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

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

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

3.13 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using approved form.
      a. Use form generated by Electronic Document Submittal Service software.
   4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
      b. Clearly indicate marks made by Contractor and marks made by others prior to submitting to Architect. Use prefix before each mark, color coded legend or another method that is clearly understandable.
   7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   8. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
   9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   10. Provide space for Contractor and Architect review stamps.
      a. Include Architect's review stamp on all submitals. Blanks to be filled out as part of Architect's review. Architect will provide stamp in electronic format.
      b. Provide space for Engineer review stamps.

11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not requested will not be recognized or processed.
15. Architect will return submittals and shop drawings to the Contractor. The Contractor shall be responsible for transmitting the reviewed submittals and shop drawings.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
4. Provide size and scale of shop drawings appropriate for type of material, system or assembly. All text, drawings, dimensions or other graphics shall be clearly legible.
   a. Shop drawings that are not clearly legible will be returned without review.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.15 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
   a. "Reviewed", or language with same legal meaning.
   b. "Furnish as corrected or reviewed - comments noted", or language with same legal meaning.
      1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
   c. "Reviewed, comments noted - Submit for record", or language with same legal meaning.
      1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
      2) Non-responsive resubmittals may be rejected.
2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit".
      1) Resubmit revised item, with review notations acknowledged and incorporated.

2) Non-responsive resubmittals may be rejected.

b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:

a. "Received" - to notify the Contractor that the submittal has been received for record only.

2. Items for which action was taken:

a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 013000

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SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 003100 - Available Project Information: Soil investigation data.

B. Section 012100 - Allowances: Allowance for payment of testing services.

C. Section 013000 - Administrative Requirements: Submittal procedures.

D. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories 2018.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:

a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.

b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
1. Temporary sheeting, shoring, or supports.
2. Temporary scaffolding.
3. Temporary bracing.
4. Temporary falsework for support of spanning or arched structures.
5. Temporary foundation underpinning.
6. Temporary stairs or steps required for construction access only.
7. Temporary hoist(s) and rigging.
8. Investigation of soil conditions to support construction equipment.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
1. Structural Design of Steel Connections: As described in Section 051200 - Structural Steel Framing.
2. Structural Design of Steel Connections: As described in Section 052100 - Steel Joist Framing.
3. Structural Design of Steel Decking: As described in Section 053100 - Steel Decking.
4. Structural Design of Metal Framing: As described in Section 054000 - Cold-Formed Metal Framing.
5. Structural Design of Metal Fabrications: As described in Section 055000 - Metal Fabrications.
6. Structural Design of Stairs: As described in Section 055100 - Metal Stairs.
7. Structural Design of Railings: As described in Section 055213 - Pipe and Tube Railings.
8. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 084313 - Aluminum-Framed Storefronts.
9. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 084413 - Glazed Aluminum Curtain Walls.
10. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 211300 - Fire-Suppression Sprinkler Systems.
11. Additional design as indicated.
a. Contractor shall employ a consultant qualified to interpret structural criteria and other applicable criteria that pertains to the project.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

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

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

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:
1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
1) Management and control of documents and records relating to quality.
2) Communications.
3) Coordination procedures.
4) Resource management.
5) Process control.
6) Inspection and testing procedures and scheduling.
7) Control of noncomplying work.
8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
9) Control of testing and measuring equipment.
10) Project materials certification.
11) Managerial continuity and flexibility.
c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.09 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

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

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3740, and as required for project.
   2. Inspection agency: Comply with requirements of ASTM D3740, ASTM E329, and as required for project.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory: Authorized to operate in the State in which the Project is located.
   5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

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

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
   1. Provide the minimum integrated exterior mock-up, unless more stringent requirments are indicated on drawings:
      a. 12 ft x 12 ft size to include all specified exterior wall materials, including complete assembly from exterior face to interior face. Include all sealants, flashing and trim and at least one window unit.

D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

J. Accepted mock-ups shall be a comparison standard for the remaining Work.

K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

L. Legally salvage and recycle the demolished mock-up materials.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

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

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

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Attend preconstruction meetings and progress meetings.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

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

END OF SECTION 014000

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SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Lists of products to be removed from existing building.

B. Section 011000 - Summary: Identification of Owner-supplied products.

C. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 014000 - Quality Requirements: Product quality monitoring.

E. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

F. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

A. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute Current Edition.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.

C. CAN/CSA Z809 - National Standard for Sustainable Forest Management; CSA International Inc. 2016.

D. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products 2014.

E. GreenScreen (LIST) - GreenScreen for Safer Chemicals List Translator; Clean Production Action Current Edition.

F. GreenScreen (METH) - GreenScreen for Safer Chemicals Method v1.2; Clean Production Action Current Edition.

G. ISO 14044 - Environmental management - Life cycle assessment - Requirements and guidelines 2006 (Amended 2020).

H. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services 2017.

I. NSF 332 - Sustainability Assessment for Resilient Floor Coverings 2015.

1.04 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 QUALITY ASSURANCE

A. GreenScreen Chemical Hazard Analysis: Ingredients of 100 parts-per-million or greater evaluated using GreenScreen (METH).
   1. Good: GreenScreen (LIST) evaluation to identify Benchmark 1 hazards; a Health Product Declaration includes this information.
   2. Better: GreenScreen Full Assessment.
   3. Best: GreenScreen Full Assessment by GreenScreen Licensed Profiler.
   4. Acceptable Evidence: GreenScreen report.

B. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

C. Rapidly Renewable Materials: Made from agricultural products that are typically harvested within a 10-year or shorter cycle.

D. Reused Products: Materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
   1. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.
   2. Acceptable Evidence: Information about the origin or source, from Contractor or supplier.

E. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
   1. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.
   2. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
   1. See Section 011000 for list of items required to be salvaged for reuse and relocation.
      a. Refer to additional information on drawings.
   2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.
   3. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 016116.
2. If wet-applied, have lower VOC content, as defined in Section 016116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste. See Section 017419
6. Are made of vegetable materials that are rapidly renewable.
7. Are made of recycled materials.
8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
9. If bio-based, other than wood, are or are made of Sustainable Agriculture Network certified products.
10. Are Cradle-to-Cradle Certified.
11. Have a published Environmental Product Declaration (EPD).
12. Have a published Health Product Declaration (HPD).
13. Have a published GreenScreen Chemical Hazard Analysis.
14. Have a published Manufacturer's Inventory of Chemical Content.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 011000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal and / or remediation of hazardous materials and toxic substances..

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 013000 - Administrative Requirements: Submittals procedures.

C. Section 014000 - Quality Requirements: Testing and inspection procedures.

D. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 015713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.

G. Section 017419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

H. Section 017610 - Temporary Protective Coverings: Materials for protection of installed work.

I. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

J. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

K. Section 024100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

L. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
   1. Minimum of (5) Five years of documented experience.

B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   2. Indoors: Limit conduct of especially noisy interior work to 8 am to 5 pm.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect (7) seven days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.
   4. Controlling lines and levels required for mechanical and electrical trades.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 at locations as required for Project. Verify locations with Owner..

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 011000 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
   4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. See Section 017610 for temporary protective covering materials.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

I. Prohibit traffic from landscaped areas.

J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect.
   2. Provide copies to Owner.
   3. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion review.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final review.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

END OF SECTION 017000

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SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final review.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
   1. Include HVAC outdoor and exhaust air damper calibration strategy.
      a. Include provisions which ensure that full closure of dampers can be achieved.
   2. Include Carbon Dioxide Monitoring Protocol.
   3. Include Carbon Monoxide Monitoring Protocol.
   4. Include Frost Mitigation Strategy for ventilation heat-recovery system.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.

3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.

K. Coordinate additional requirments with Owner.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 017800

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.

3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc. Verify with Owner.
      a. Additional Format: USB Flash Drive or Digital download.
   2. Label each disc and container with session identification and date.
   3. Label each recording file with the session identification and date, plus project title.
   4. Audio-video recordings shall be delivered in Mp4 digital format, in minimum 1080 dpi resolution, without compression (other than H-264) applied.
   5. Audio-video recordings shall be edited to eliminate any outtakes or extended interruptions or delays that occur during the presentation, as well as any pre or post presentation preparation or wrap-up activities or conversations.
   6. Deliver all video recordings on a single USB or external hard drive, with a gallery layout or list showing all recorded sessions by title and date, linked to the respective recording for immediate playback when clicked.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

B. Videographer Qualifications: An established commercial videographer with a min of 5-years experience in recording construction-related audio and video presentations on location.
   1. Provide examples of prior work and a minimum of three references in recording training sessions.
   2. Ensure that the video image is stable (employing image stabilization or use of a tripod when appropriate) and composed to include presenter and associated equipment systems.
   3. Ensure audio track records presenter with minimal interference from ambient sound and equipment noise. “Mic-up” the presenter individually to ensure proper sound recording and ask presenter to repeat Q&A questions before answering.
   4. Any audio-video recordings that do not meet the above standards shall be rescheduled and re-recorded, with the original presenter, or an approved alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 017900

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SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 003100 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.

B. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

C. Section 011000 - Summary: Sequencing and staging requirements.

D. Section 011000 - Summary: Description of items to be removed by Owner.

E. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

F. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

G. Section 015713 - Temporary Erosion and Sediment Control.

H. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

I. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

J. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

K. Section 026500 - Underground Storage Tank Removal.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five years of documented experience.

PART 3 EXECUTION

2.01 SCOPE

A. Extent of demolition is indicated on drawings.

B. Remove paving and curbs as required to accomplish new work.

C. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.

D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.

E. Remove concrete slabs on grade as indicated on drawings.

F. Remove manholes and manhole covers, curb inlets and catch basins.

G. Remove fences and gates.

H. Additional demolition as indicated on drawings and as required for new work.

I. Remove other items indicated, for salvage, relocation, and recycling.

J. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 017000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

F. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

H. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

I. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 017419 - Waste Management.
   2. Dismantle existing construction and separate materials.
   3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

J. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

K. Underground Storage Tanks: Remove and dispose of as specified in Section 026500.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations as required for project or as directed by Owner.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.

2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. See Section 011000 for other limitations on outages and required notifications.
4. Verify that abandoned services serve only abandoned facilities before removal.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 017419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

SECTION 03 3300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Slabs-on-grade.

B. Related Sections include the following:
   1. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. 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.

C. 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.

D. Samples: For waterstops and vapor retarder.

E. Qualification Data: For installer, manufacturer and testing agency.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

G. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semi-rigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

I. Field quality-control test and inspection reports.

J. Minutes of pre-installation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. 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.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent containing VOC's less than 250 grams per liter 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.

H. 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 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

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.

B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

C. Bar Supports: Use only concrete bricks as supports under rebars (regular rebar chairs not permitted)

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/II gray. Supplement with the following:
      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, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inch nominal for foundations, stem walls and slabs on grade; 1 inch nominal for elevated slabs.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C330, ¾-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. 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.

2.7 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Available Products:
   a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
   b. Concrete Sealants Inc.; Conseal CS-231.
   c. Greenstreak; Swellstop.
   d. Henry Company, Sealants Division; Hydro-Flex.
   e. JP Specialties, Inc.; Earthshield Type 20.
   f. Progress Unlimited, Inc.; Superstop.
   g. TCMiraDRI; Mirastop.

2.8 VAPOR BARRIERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A vapor retarder with minimum WVTR of 0.008 as tested by ASTM E96 and permeance as tested after mandatory conditioning (ASTM E 154 sections 8,11,12,13) less than 0.01 Perms. Include manufacturer's recommended adhesive or pressure-sensitive tape (minimum width of tape shall be 4 inches). Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer’s recommendations.
1. Available Products:
   a. Stego Wrap (15 mil) Vapor Barrier by Stego Industries
   b. Ecoshield-E (15 mil) Epro
   c. Iron Barr (15 mil) Flatiron Films

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.

2.9 CURING MATERIALS

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

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

C. Water: Potable.

2.10 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces. Apply only to areas scheduled for 'sealed concrete' floor finish. Refer to drawings for location. Protect slab from discoloration prior to applying floor treatment. Clean slab as recommended by floor treatment manufacturer if necessary prior to floor treatment application.
   1. Products:
      a. ChemMasters; Chemsil Plus.
      b. ChemTec International; ChemTec One.
      c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
      d. Curecrete Distribution Inc.; Ashford Formula.
      e. Dayton Superior Corporation; Day-Chem Sure Hard.
      f. Euclid Chemical Company (The); Euco Diamond Hard.
      g. Kaufman Products, Inc.; SureHard.
      h. L&M Construction Chemicals, Inc.; Seal Hard.
      i. SpecChem; SpecHard.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 20 percent.
   2. Combined Fly Ash and Pozzolan: 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, high-range water-reducing or plasticizing 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.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture for Footings and Piers as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days or as shown on drawings.
   2. Maximum Water-Cementitious Materials Ratio: 0.57.
   3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
   4. Slump Limit: 6 inches, plus or minus 1 inch.
   5. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

B. Proportion normal-weight concrete mixture for Slabs-on-Grade as follows:
   1. Minimum Compressive Strength: 3500 psi at 28 days or as shown on drawings.
   2. Maximum Water-Cementitious Materials Ratio: 0.49.
   3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
   4. Slump Limit: 4 inches, plus or minus 1 inch.
   5. Air Content: Do not allow air content of troweled finished slabs to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

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

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. 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. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.

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

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

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 at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 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.
1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. 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: See drawings for locations. 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.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

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.

3.6 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.7 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.

H. After a rain event, the contractor must delay concrete placement for slabs on grade until the subgrade is dry. The contractor may use commercial air blowers to remove accumulated water.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and

defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. 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, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, 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.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten 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 to be exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 31; and of levelness, F(L) 24; for slab-on-grade in atrium lobby.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
    1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
    1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

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.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

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 **six** months. 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 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, pop-outs, 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 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.
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.

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: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections, sample materials and prepare test reports.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs, hooked anchor bolts and other embedded steel anchors
4. Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during pour.
5. Certify each delivery ticket indicating class of concrete delivered (or poured), amount of water added and time at which cement and aggregate were discharged into truck, and time at which concrete was discharged from truck.
6. Verification of use of required design mixture.
7. Concrete placement, including conveying and depositing.
8. Curing procedures and maintenance of curing temperature.
9. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Contractors Responsibilities:
1. Furnish necessary labor to assist testing agency in obtaining and handling samples at job-site.
2. Advise testing agency in advance of operations to allow for assignment of testing personnel and testing.
3. Provide and maintain for use of testing agency adequate facilities for proper curing of concrete test specimens on project site in accordance with ASTM C31

D. 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 75 cu. yd. or fraction thereof.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Test to be taken from sample at point of discharge from hose. Perform additional tests when concrete consistency appears to change.
3. 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.
4. 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.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

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.
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. Concrete for which strength tests do not meet criteria for acceptance shall be considered inadequate until proven otherwise.
12. Completed concrete work will be accepted when the requirements of ACI 301, Chapter 18 have been complied with.
13. In any case, where strength tests of concrete fail to meet criteria specified herein, Architect shall be sole judge of structural adequacy of concrete. In such case, burden of proof of structural adequacy shall be responsibility of Contractor. Strength evaluation shall conform to requirements of ACI 318. If strength evaluation testing indicates, in opinion of Architect, that structure is of inadequate strength; portions of structure in question shall be repaired or removed and replaced as directed by Architect at no additional expense to Owner. If strength tests fall below specified strength, but not so low as to cause concern for structural adequacy, Architect may request improved conditions of curing or modification of design mixes to improve strength.
14. 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.
15. 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.
16. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
17. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033300

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Grout.

B. Related Sections include the following:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Steel Decking" for field installation of shear connectors.
3. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 09 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 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 type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Do not begin fabrication of materials prior to review of shop drawings.
6. Review of shop drawings is for member sizes, spacing, details, and general compliance with Contract Drawings only.
7. Material quantities, lengths, fit, verification of job conditions and coordination with other trades are responsibility of Contractor.
8. Reproductions of Contract Drawings shall not be used for shop drawings

C. Welding certificates.

D. Qualification Data: For Installer, fabricator and testing agency.

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. Shop primers.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Not less than 5 years of experience in erection of structural steel for projects of similar size and complexity.

B. Fabricator Qualifications: Not less than 5 years of experience in erection of structural steel for projects of similar size and complexity.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1. Welders are to be employed on work shall maintain current AWS certification throughout duration of project.
2. If requested by Architect, submit identifying stenciled test coupons made by operator whose workmanship is subject to question, and if reasonable doubt of proficiency exists, welder shall be re-qualified and certified by independent testing laboratory at no additional expense to Owner.
3. Work suspected of deficient quality may be subject to removal of coupons from any location on any joint for testing. Remove section of welds found defective and properly re-weld before proceeding with work.

E. 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 "Load and Resistance Factor Design Specification for Structural Steel Buildings".
5. AISC's "Specification for the Design of Steel Hollow Structural Sections."
6. AISC's "Specification for Allowable Stress Design of Single-Angle Members".
7. AISC’s "Specification for Load and Resistance Factor Design of Single-Angle Members".
8. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 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.

1.7 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/A 992M (Grade 50).

B. Channels and Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, 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: Unless noted otherwise on Contract Documents, 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. Plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight or Hooked as indicated on the contract documents.
2. Nuts: ASTM A 563 heavy hex carbon steel.

3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain unless noted otherwise on the Contract Documents.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain unless noted otherwise on the Contract Documents.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened carbon steel.
3. Finish: Plain unless noted otherwise on the Contract Documents.

G. Slide Bearings: Constructed of filled ‘Teflon’ bonded to flat rigid back-up lates.

1. Representative product and suppliers:

a. Con-Slide Bearings, Type CSA as manufactured by Con-Serv, In.c, 685 Aviation Blvd., Georgetown, SC 29440, (803) 546-1044.

b. Fluorogold Slide Bearings as manufactured by: Seismic Energy Products, L.P., 518 Progress Way, Athens, TX 75751, (903) 675-8571

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

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

B. Galvanizing Repair Paint: ASTM A 780.

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. 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" or "Load and Resistance Factor Design Specification for Structural Steel Buildings"

1. Camber structural-steel members where indicated.

2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. 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.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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: Snug tightened unless noted otherwise on Contract Documents.

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.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 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.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels and shelf angles attached to structural-steel frame and 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 inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of erection implies acceptance of existing conditions.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

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" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings" 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.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories**,** bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 05 3100
STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

E. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

F. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

C. Do not overload deck during construction by workmen or storage of materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:
    a. Consolidated Systems, Inc.
    b. Epic Metals Corporation.
    c. Marlyn Steel Decks, Inc.
    d. New Millennium Building Systems, LLC.
    e. Nucor Corp.; Vulcraft Division.
    f. Roof Deck, Inc.
    g. United Steel Deck, Inc.
    h. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating.
2. Deck Profile: As indicated on Contract Documents.
3. Profile Depth: As indicated on Contract Documents.
4. Design Uncoated-Steel Thickness: As indicated on Contract Documents.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psiof same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth or as indicated on the Contract Documents.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch wide flanges and recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

J. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

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

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Do not proceed with installation until all unsatisfactory existing conditions are corrected. Commencement of installation implies acceptance of existing conditions.

B. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

C. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

D. Locate deck bundles to prevent overloading of supporting members.

E. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

F. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

G. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

I. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

J. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch nominal.
2. Weld Spacing: Space welds as indicated on the Contract Documents.
3. Weld Washers: As indicated on the Contract Documents.

B. Side-Lap and Perimeter Edge Fastening: as indicated on the Contract Documents

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches , with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

F. Install 6-inch minimum wide sheet steel cover plates of same thickness as deck where deck changes direction. Mechanically attach at 6 inches on center maximum.

G. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer’s recommendations. Weld to substrate to provide a complete deck installation.

H. Do not attach hangers for ceiling grids, ductwork, and mechanical piping directly to metal roof deck.

I. Place metal cant strips in position and mechanically attach.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Painting.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.

B. Related Sections include the following:

   1. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Connection: Submit manufacturer’s data for each type of manufactured connection, screw, or fastener verifying conformance with Contract Drawings.

C. Welding certificates.

D. Qualification Data: For testing agency.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Horizontal drift deflection clips
   7. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. California Expanded Metal Products Company.
2. Clark Steel Framing.
3. Consolidated Fabricators Corp.; Building Products Division.
4. Dietrich Metal Framing; a Worthington Industries Company.
5. MarinoWare; a division of Ware Industries.
6. Quail Run Building Materials, Inc.
7. SCAFCO Corporation.
8. United Metal Products, Inc.
9. Studs Unlimited

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ASTM A653. Minimum yield strength of 33 ksi (33,000 psi) with the exception that 16 gauge and heavier studs and joists shall have a minimum yield strength of 50 ksi.
2. Coating: G60

B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1 or 2.
2. Coating: G90

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated on the Contract Documents.
2. Section Properties As indicated on the Contract Documents.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, un-punched, with un-stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated on the Contract Documents. Flange Width: 1-1/4.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as indicated on the Contract Documents, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.
c. SCAFCO Corporation
d. The Steel Network, Inc.

D. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.

10. Hole reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation implies acceptance of existing conditions.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to Contract Documents, AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Securely anchor track to floor and overhead structure or members. Abutting pieces of track shall be securely anchored to a common structural element, or they shall be butt welded or otherwise spliced together.

G. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

H. Attachments of exterior metal framing components shall be as indicated or if not indicated, as recommended by the manufacturer for the design loads and applications indicated. Dissimilar structural components shall be attached by welding, screw attachment, or bolting. Wire tying of framing components in structural applications shall not be permitted.

I. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

J. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

K. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

L. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as indicated on the Contract Documents.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
2. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 05500
METAL FABRICATION

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. 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. Shelf angles.
4. Loose bearing and leveling plates.
5. Metal ladders.
6. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

C. Related Sections include the following:
1. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
2. Division 5 Section "Structural Steel."
3. Division 5 Section "Pipe and Tube Railings."
4. Division 6 Section " Miscellaneous Carpentry" for metal framing anchors.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 metal fabrications 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.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

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.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: As indicated.
2. Material: Steel complying with ASTM A 1008/A 1008M, commercial steel, Type B structural steel, Grade 33 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.

2.4 NONFERROUS METALS

A. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

B. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563 ; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the

load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

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

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. 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.

G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi , unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.12 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. Space side rails 18 inches apart, unless otherwise indicated.
3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
2. Rungs: 1-inch-diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
5. Products:

    a. IKG Industries, a Harsco company; Mebac.
    b. W. S. Molnar Company; SlipNOT.

6. Galvanize exterior ladders and interior ladders, where indicated, including brackets and fasteners.

2.13 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

1. Cap bollards with 1/4-inch-thick steel plate.

2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 COPPER-ALLOY FINISHES

A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

B. Extruded-Nickel Silver Finish: M11 (Mechanical Finish: specular, as fabricated).

C. Bronze Plate, Sheet, Strip, and Bar Finish: M10 (Mechanical Finish: unspecified, as fabricated).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges

and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.
B. Underlayment.
C. Roof-mounted curbs.
D. Roofing nailers.
E. Roofing cant strips.
F. Preservative treated wood materials.
G. Fire retardant treated wood materials.
H. Miscellaneous framing and sheathing.
I. Concealed wood blocking, nailers, and supports.
J. Miscellaneous wood nailers, furring, and grounds.
K. Fire-Retardant Treated Wood roof decking and / or framing to match existing construction where indicated or required to remain.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
B. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.
C. Section 076200 - Sheet Metal Flashing and Trim: Sill flashings.
D. Section 077200 - Roof Accessories: Prefabricated roof curbs.
E. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2016.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
D. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
E. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
G. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
H. PS 1 - Structural Plywood 2009 (Revised 2019).
I. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.
J. PS 20 - American Softwood Lumber Standard 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Provide sustainably harvested wood; see Section 016000 - Product Requirements for requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site, where possible.

D. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

E. Lumber fabricated from recovered timber (abandoned in transit) is permitted, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings and as required for Project, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

2.04 CONSTRUCTION PANELS

A. Underlayment: APA Underlayment; plywood, Exposure 1, 1/2 inch (12.5 mm) thick. Fully sanded faces at resilient flooring.

B. Wall Sheathing, For Inside face of parapet walls with LWIC roofing, or where required by roofing type, and where indicated on drawings: Any PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.
   3. Span Rating: 16.
   4. Performance Category: 3/4 PERF CAT.
   5. Edge Profile: Contractor’s option to suite application.

2.05 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
      a. Not allowed at exterior applications.

B. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.

C. Water-Resistive Barrier: As specified in Section 072500.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat all exterior rough carpentry items.
      c. Do not use treated wood in direct contact with the ground.
   2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

b. Treat lumber exposed to weather.
c. Treat lumber in contact with roofing, flashing, or waterproofing.
d. Treat lumber in contact with masonry or concrete.
e. Treat lumber less than 18 inches (450 mm) above grade.

2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   b. Treat plywood in contact with roofing, flashing, or waterproofing.
   c. Treat plywood in contact with masonry or concrete.
   d. Treat plywood less than 18 inches (450 mm) above grade.
3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
   a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
   b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Additional locations as indicated on Drawings or as required for project.
   9. Wall paneling and trim.
   10. Joints of rigid wall coverings that occur between studs.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

C. Contractor to evaluate existing wood roof decking / framing at existing gym building. Repair or replace all damaged or deteriorated wood in-kind to match existing unless more stringent requirments are indicated on structural drawings.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

3.05 CLEANING

A. Waste Disposal: Comply with the requirements of Section 017419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061000

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SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.
   1. Finish carpentry items are indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 081416 - Flush Wood Doors.

D. Section 099123 - Interior Painting: Painting and Finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. AWI (QCP) - Quality Certification Program Current Edition.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

E. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.

F. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

I. PS 1 - Structural Plywood 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and other items as indicated on drawings.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.
   3. Provide instructions for attachment hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, seam locations, pattern orientation, installation methods, corner conditions, details and accessories.
   1. Indicate interface with adjacent work.
      a. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
      b. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
      c. Include certification program label.
      d. Include other finish carpentry items indicated on drawings.

D. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum ten years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org.
   2. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 MOCK-UP

A. See Section 014000 - Quality Requirements for additional requirements.

B. Locate as indicated on drawings.

C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

E. Follow manufacturer's recommendations.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. As indicated on drawings.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).

2.03 LUMBER MATERIALS

A. Hardwood Lumber: White Oak species, plain sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.

2.04 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Hardwood Plywood: Face species as indicated, plain sawn, balance matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.05 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; color as indicated.

B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.06 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

C. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
   1. Unless more stringent conditions are indicated on drawings.

B. Lumber for Shimming and Blocking: Softwood lumber of any species.

C. Wood Filler: Solvent base, tinted to match surface finish color.

D. As indicated on drawings.

2.08 HARDWARE

A. Hardware: Comply with BHMA A156.9.

2.09 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

C. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

D. Provide identification on fire retardant treated material.

E. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

F. Kiln dry wood after pressure treatment to maximum percent moisture content as recommended by manufacturer.

2.10 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.11 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with 3/8 inch matching hardwood (9 mm matching hardwood) edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Unless otherwise indicated on drawings.

2.12 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Sheen: Flat.
      c. Unless otherwise indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.

C. Set and secure materials and components in place, plumb and level.

D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION 062000

SECTION 072500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

1. Vapor permeable.
2. Locations are indicated on drawings: Air / Moisture Barrier.
3. Fluid applied.
    a. Contractor may use membrane products where allowable by exterior material manufacturer in lieu of fluid applied.
        1) Required membrane locations include all outside corners, six inches on each side and as indicated on drawings.
    b. Plastic sheet products, felt or building paper is not allowed.
    c. High-Temperature (240 deg F, minimum) at metal walls or roof materials and where indicated or required by cladding manufacturer.

1.02 RELATED REQUIREMENTS

1.03 RELATED REQUIREMENTS

A. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

B. Section 079200 - Joint Sealants: Sealing building expansion joints.

1.04 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

1.05 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure 2018, with Editorial Revision (2019).

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016, with Editorial Revision (2019).

I. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials 2017.

J. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2019.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

1. Provide project-specific details for all application types.
2. Show interface with adjacent work.
3. Clarify work as part of this Section and by other Sections.

D. Submit five previous projects of similar size and scope to work specified.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

H. Testing Agency Qualification Statement.

1.07 QUALITY ASSURANCE

A. Follow Air Barrier Association of America (ABAA) Quality Assurance Program (QAP) recommendations; www.airbarrier.org/#sle.

B. Installer Qualification: Installer Qualifications: Company specializing in performing work of type specified and with at least ten years documented experience.

C. Manufacturer Qualification: Use materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.08 MOCK-UP

1.09 FIELD CONDITIONS

A. Install Air / Moisture Barrier materials in integrated exterior mock-up specified in Section 014000.

B. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air / Moisture Barrier: Provide on exterior walls under exterior cladding and where indicated in other sections.
1. Provide continuous air / moisture barrier throughout entire building envelope, including horizontal to vertical transitions and under different finish materials. Seal all penetrations air and water tight.
2. Continuous air / moisture barrier is required at all locations whether or not shown on drawings.

B. Contractor to coordinate the compatibility of all system components with insulation and other materials. Provide accessory materials as required for a complete assembly.

C. Seal all building envelope seams, gaps and material transitions air-tight.

2.02 SEALANTS

A. All sealants to comply with ASTM C920, elastomeric polymer sealant to maintain watertight condition.

B. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

2.03 ADHESIVES

A. Provide adhesive recommended by manufacturer.

2.04 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970.

C. Flexible Flashing: Sheathing fabric saturated with air barrier coating and complying with the applicable requirements of ICC-ES AC148.

D. Pre-formed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, tear resistant.

E. Liquid Flashing: One part, fast curing, non-sag elastomeric STPU (Silyl-Terminated Polyurethane) gun grade, trowelable liquid flashing.

F. Stainless Steel Flashing: Flexible flashing with 8 mil, 0.008 inch (0.203 mm) thick sheet of Type 304 stainless steel, 8 mil, 0.008 inch (0.203 mm) of butyl adhesive and a siliconized release liner.

G. Sheet Membrane Mounting Tape: Double-sided strip of pressure-sensitive, acrylic adhesive reinforced with embedded fiber-strand carrier layer and plastic backing.
   1. Width: 3/4 inch (19 mm).
   2. Roll Length: 164 feet (50 m).
   3. Thickness: 14 mil, 0.014 inch (0.356 mm).

H. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.

I. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

D. Self-Adhered Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps air tight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
   5. At wide joints, provide extra flexible membrane allowing joint movement.

E. Coatings:
   1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
   2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.

3. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch (6 mm); use sheet seal to join to adjacent construction, seal air tight with sealant.
4. Use flashing to seal to adjacent construction and to bridge joints.

F. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072500

SECTION 074213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, soffit panels, and subgirt framing assembly, with related flashings and accessory components.
   1. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Downspouts adjacent to metal wall panels

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 072500 - Weather Barriers: Weather barrier under wall panels.

C. Section 077123 - Manufactured Gutters and Downspouts: Downspout boots.

D. Section 079200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Include installation instructions.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, details of edge and penetration conditions, spacing and type of connections, flashings and special conditions, and methods of anchorage.
   1. Include downspouts.
   2. Include accessories.
   3. Include project-specific details.
   4. Show work to be field-fabricated or field-assembled.
   5. Show interface with other work.
   6. Show all proposed seam and joint locations.
   7. Do not use architect's drawings as shop drawings.
   8. Scale of shop drawing details not less than 3" = 1'-0".
   9. Show drawings, text and dimensions in black and white at a clear legible scale and size.
      a. Color drawings that are not clearly legible will be returned without review.

D. Samples: Submit two samples of wall panel, 12 inch by 12 inch (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Calculations:
   1. Include calculations with registered engineer seal, verifying wall panel and attachment methods resist wind pressures imposed on it pursuant to applicable building codes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum ten years of documented experience.

1.06 MOCK-UP

A. Construct mock-up, 12 feet (3.6 m) long by 12 feet (3.6 m) wide; include panel trim to adjacent materials system, glazing, attachments to building frame, associated air / moisture barrier materials, weep drainage system, sealants and seals, related insulation, and as indicated on drawings and integrated exterior material mock-up requirments specified in Section 014000 in mock-up.

B. Locate where directed by Architect.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Metal Wall / Soffit Panels - Flush-Profile, Concealed Fasteners; Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels: FW-1025 Panel manufactured by Berridge Manufacturing Company: www.berridge.com..
   2. Substitutions: See Section016000-Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall / Soffit Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Vented sofit panels to match. Locate as indicated on drawings.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.

C. Provide exterior wall panels and subgirt framing assembly.
   1. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   2. Design Pressure: In accordance with applicable codes.
      a. And as indicated on drawings.

3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
7. Corners: Factory-fabricated in one continuous piece with minimum 2 inch (51 mm) returns.
8. Provide continuity of air / moisture barrier seal at building enclosure elements in accordance with materials specified in Section 072500.
9. Exterior Wall / Soffit Panels:
    a. Profile: Vertical; style as indicated.
    b. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
    c. Material: Precoated steel sheet, 22 gage, 0.0299 inch (0.76 mm) minimum thickness.
    d. Panel Width: 10.5 nominal caverage inches (260 mm).
    e. Color: As indicated on drawings.
10. Subgirt Framing Assembly:
    a. Provide a thermally broken attachment system for attachment of exterior cladding installed over continuous exterior-insulation.
    b. 16 gage, 0.0598 inch (1.52 mm) thick formed non-precoated steel sheet.
    c. Unless more stringent conditions are indicated on drawings.
11. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
12. Expansion Joints: Same material, thickness and finish as exterior sheets; thick; manufacturer's standard brake formed type, of profile to suit system.
13. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
14. Anchors: Galvanized steel.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

E. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

2.03 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant.

C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.

E. Field Touch-up Paint: As recommended by panel manufacturer.

F. Bituminous Paint: Asphalt base.

G. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

1. Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
2. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

H. Downspouts: Formed from same material and manufacturer's run as wall panels unless indicated otherwise on drawings. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match wall panels . Furnish supports spaced a maximum of 36 inches on center, fabricated from same metal as downspouts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at 24 inches on center, maximum (at 610 mm on center, maximum).
1. Unless more stringent conditions as indicated on drawings.

3.03 INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Lap panel ends minimum 2 inches (51 mm).

F. Provide expansion and control joints where indicated or where required by manufacturer.

G. Use concealed fasteners unless otherwise approved by Architect.

H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6.4 mm).

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

E. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION 074213

SECTION 074213.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior curtain wall system consisting of formed metal composite material (MCM) sheet, framing, secondary supports, and anchors to structure.

B. Matching flashing and trim.

C. Exterior locations are indicated on drawings.

1.02 DEFINITIONS

A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

B. DBVR: Drained and back-ventilated rainscreen system; rainscreen system designed to drain and dry cavity entering water through drainage channels, weeps, and air ventilation.

1.03 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Installation of anchors.

B. Section 042000 - Unit Masonry: Installation of anchors.

C. Section 054000 - Cold-Formed Metal Framing: Panel support framing.

D. Section 072500 - Weather Barriers: Weather barrier behind wall panel system.

E. Section 076200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

F. Section 079200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

F. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip 2020a.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

I. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

N. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives 1998 (Reapproved 2021).

O. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics 2020.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

Q. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

R. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

S. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2019.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Include fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
      a. Indicate panel numbering system.
      b. Differentiate between shop and field fabrication.
      c. Indicate substrates and adjacent work with which the wall system must be coordinated.
      d. Include large-scale details of anchorages and connecting elements.

e. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing, drainage system, and rainscreen interface at a scale of not less than 1-1/2 inches per 12 inches (1:10).
f. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
g. Provide project-specific details.
h. Do not use architect's drawings as shop drawings.

E. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's standard range of available colors and patterns.
1. Sealant Color: Color to match wall panels.
a. Unless otherwise indicated.

F. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch (305 mm) square, and representing actual product in color and texture.

G. Certificate: Certify that the work results of this section meet or exceed specified requirements.

H. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

I. Product Test Reports: For each product, tests performed by a qualified testing agency.
1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
2. MCM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on MCM system type provided.
a. Dry System: Tested to AAMA 501.
b. DBVR System: Tested to AAMA 509.

J. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

K. Test Report: Submit report of full-size mock-up test for NFPA 285 fire performance.

L. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

M. Designer's Qualification Statement.

N. Manufacturer's Qualification Statement.

O. Installer's Qualification Statement.

P. Field quality control reports.

Q. Testing Agency's Qualification Statement.

R. Maintenance Data: Care of finishes and warranty requirements.

S. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

T. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.07 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.

1. With not less than fifteen years of documented experience.
2. Approved by MCM sheet manufacturer.
3. Submit contact names and phone numbers for at least three references connected with successful past projects.

D. Fabricator Qualifications: Approved by Manufacturer.

E. Installer Qualifications: Company specializing in performing work of the type specified in this section.
1. With minimum fifteen years of documented experience.
   a. Installer must have completed at least 5 major projects in the specified aluminum composite material panel system.
2. Approved by wall panel system manufacturer.
3. Submit contact names and phone numbers for at least three references connected with successful past projects.

F. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

G. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
1. Locate where directed.
2. Provide panels finished as specified.
3. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
1. Protect finishes by applying heavy duty removable plastic film during production.
2. Package for protection against transportation damage.
3. Provide markings to identify components consistently with drawings.
4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in well ventilated space out of direct sunlight.
2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
3. Store at a slope to ensure positive drainage of any accumulated water.
4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a twenty year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions. www.edacontractors.com

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:

B. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. 3A Composites USA; Alucobond Plus: www.3Acompositesusa.com.
   2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-americas.com.
   3. Omega-Lite panels manufactured by Laminators Inc.; www.laminatorsinc.com.
   4. Substitutions: See Section 016000 - Product Requirements.

C. Wall Panel System Manufacturers:

D. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Sobotec; SL2000 Dry Joint System; www.sobotec.com.
      a. Sobotec Limited – SLT Clip / Rail.
   2. Art-form; www.art-form.com.
   3. Laminators Inc.; www.laminatorsinc.com
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
   3. Anchor panels to supporting framing without exposed fasteners.
   4. No framing component may penetrate the layer of continuous exterior insulation other than thermally isolated fasteners.

2.03 PERFORMANCE REQUIREMENTS

A. Provide tests on full-size mock-ups; tests performed previously for other projects are acceptable provided tested assemblies are truly equivalent to those to be used on this project, unless otherwise indicated.

B. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

C. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
   1. Wind Loads: As indicated on drawings.
      a. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
      b. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
      c. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.

D. Air Leakage: Not more than 0.006 (cfm)/sf of wall area 0.11$m^3/h/m^2$, when tested at 6.24 psf (300 Pa) in accordance with ASTM E283.

E. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 14.61 psf (700 kPa) minimum, after 15 minutes.
   1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
   2. Design to drain leakage and condensation to the exterior face of the wall.

F. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing must be performed specifically for this project.

G. Building Envelope Performance: Complies with ASHRAE Std 90.1 I-P when tested as part of a building envelope assembly.

2.04 PANELS

A. MCM Wall Panel Systems: Provide factory-formed and -assembled, MCM wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners and accessories required for weathertight system.

B. Panels: One inch (2.5 mm) deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Reinforce corners with riveted aluminum angles.
   2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
   4. Reinforce panels over 16 inches (406 mm) long with metal angle braces 24 inches (610 mm) on center in short direction.
      a. Unless otherwise required by system manufacturer.
   5. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
   6. Metallic Finished Panels: Maintain consistent grain of MCM sheet; specifically, do not rotate sheet purely to avoid waste.
   7. Fabricate panels under controlled shop conditions.
   8. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   9. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
      a. Make panel lines, breaks, curves and angles sharp and true.
      b. Keep plane surfaces free from warp or buckle.
      c. Keep panel surfaces free of scratches or marks caused during fabrication.
   10. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
   11. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.05 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
   1. Overall Sheet Thickness: 0.157 inch (4 mm), minimum.
   2. Face Sheet Thickness: 0.019 inches (0.50 mm), minimum.
   3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
   4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
   5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   6. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater, when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   1. Provide framing that is thermally broken from building structure.
   2. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
   3. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
   4. Stainless Steel Sheet Components: ASTM A480/A480M.
   5. Aluminum Components: ASTM B209 (ASTM B209M); or ASTM B221 (ASTM B221M).
   6. Refer to Section 054000 for additional requirements on panel support framing.

2.06 FINISHES

A. Color/Texture: As selected by Architect from manufacturer's full or custom range.

2.07 ACCESSORIES

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

B. Flashing: Sheet aluminum; 0.040 inch (1.0 mm) thick, minimum; finish and color to match MCM sheet; refer to Section 076200 for additional requirements.

C. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   2. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.
   3. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 10.

D. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

F. Fasteners:

1. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
2. Bolts: Stainless steel.
3. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

G. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.

B. Examine dimensions, tolerances, and interfaces with other work.
1. Verify that weather barrier system is properly installed, refer to Section 072500 for requirements.

C. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Provide anchorage items to be cast into concrete, built into masonry, or as detailed to appropriate installer(s) together with setting templates.
1. Refer to Section 033000 for additional cast in place concrete requirements.
2. Refer to Section 042000 for additional unit masonry requirements.

3.03 INSTALLATION

A. Rainscreen Installation: Install using Fabricator's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material (MCM) wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

B. DBVR System: Install using Fabricator's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by Fabricator. Attach MCM wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
   2. 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 (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

E. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

F. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

G. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

H. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

I. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

J. Where joints are designed for field applied sealant, seal joints completely with specified sealant.

K. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

L. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.

M. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet (3 m) under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

A. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

B. Site Visits: Schedule two site visits during execution of installation.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION 074213.23

SECTION 075423
THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING - CARLISLE

PART 2 PRODUCTS

1.01 MANUFACTURER

A. Carlisle SynTec Systems: www.carlisle-syntec.com.

B. Substitutions: See Section 016000 - Product Requirements.

1.02 ROOFING APPLICATIONS

A. TPO Membrane Roofing: One ply membrane, asphalt adhered, over insulation.

B. Roofing Assembly Performance Requirements and Design Criteria:

1.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane:
   1. Material: Thermoplastic Polyolefin (TPO) complying with ASTM D6878/D6878M.
   2. Products:

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

D. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

1.04 INSULATION

1.05 ACCESSORIES

A. Prefabricated Flashing Accessories:
   1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
   2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
   3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
   4. Pressure Sensitive Cover Strips: 6 inches (152 mm) wide, 45 mil, 0.045 inch (1.1 mm) thick, non-reinforced TPO membrane laminated to 35 mil, 0.035 inch (0.9 mm) thick cured synthetic rubber with pressure sensitive adhesive.
   5. Miscellaneous Flashing: Non-reinforced TPO membrane; 80 mil, 0.080 inch (2.0 mm) thick, in manufacturer's standard lengths and widths.

B. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

C. Sealants: As recommended by membrane manufacturer.
   1. Product:

D. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.
   1. Product: Carlisle Weathered Membrane Cleaner.

E. Edgings and Terminations: Manufacturer's standard edge and termination accessories.

END OF SECTION 075423

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SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts and other items indicated or required for project.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.
   1. Refer to drawings for locations of concrete slabs at downspouts.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 077100 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

C. Section 077123 - Manufactured Gutters and Downspouts.

D. Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2021.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

G. CDA A4050 - Copper in Architecture - Handbook current edition.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
   1. Include accessories.
   2. Include project-specific details.
   3. Show work to be field-fabricated or field-assembled.
   4. Show interface with other work.
   5. Show all proposed seam and joint locations.
   6. Do not use architect's drawings as shop drawings.
   7. Scale of shop drawing details not less than 1-1/2" = 1'-0".
   8. Show drawings, text and dimensions in black and white at a clear legible scale and size.
   9. Color drawings that are not clearly legible will be returned without review.
   10. Show Work covered by this section and clarify Work furnished by other sections.

C. Samples: For each exposed product and for each color and texture specified.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
   1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
   2. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   3. Color: As selected by Architect from manufacturer's standard colors.
      a. Unless indicated on drawings.
      b. Existing Sheet Metal Flashing and Trim Repair or Replacement: Match existing, unless otherwise indicated on drawings.

C. Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) (0.81 mm) thick; anodized finish of color as selected.

D. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with fluoropolymer coating.

E. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) (0.40 mm) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.
   1. Unless required to matched existing.

B. Downspouts: Rectangular profile.
   1. Unless required to matched existing.

C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

F. Downspout Boots: Cast iron.

G. Downspout Extenders: Same material and finish as downspouts.

H. Seal metal joints.

2.04 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Underlayment: Polyethylene, 6 mils (0.15 mm) thick.

C. Slip Sheet: Rosin sized building paper.

D. Primer: Zinc chromate type.

E. Protective Backing Paint: Zinc molybdate alkyd.

F. Concealed Sealants: Non-curing butyl sealant.

G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

H. Plastic Cement: ASTM D4586/D4586M, Type I.

I. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Evaluate existing Sheet Metal Flashing and Trim, including gutters and downspouts, indicated as existing remain. Repair or replace as required for fully functional drainage.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Conform to drawing details.
   1. SMACNA (ASMM), Details, as applicable to project.

B. Secure flashings in place using concealed fasteners.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.

H. Connect downspouts to downspout boots, and grout connection watertight.

END OF SECTION 076200

SECTION 077100
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, gravel stops, and work as indicated on drawings and as required for project not specified elsewhere.
   1. Coping profiles and locations are indicated on drawings.

B. Roof control and expansion joint covers.

1.02 RELATED REQUIREMENTS

A. Section 076200 - Sheet Metal Flashing and Trim: Fabricated sheet metal items.

B. Section 077200 - Roof Accessories: Manufactured curbs and roof hatches.

C. Section 133419 - Metal Building Systems: Metal framing and accessories as part of Metal Building System.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2021.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

E. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

G. NRCA (RM) - The NRCA Roofing Manual 2023.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
   1. Include accessories.
   2. Include project-specific details.
   3. Show work to be field-fabricated or field-assembled.
   4. Show interface with other work.
   5. Show all proposed seam and joint locations.
   6. Do not use architect's drawings as shop drawings.
   7. Scale of shop drawing details not less than 1-1/2" = 1'-0".
   8. Show drawings, text and dimensions in black and white at a clear legible scale and size.
   9. Color drawings that are not clearly legible will be returned without review.
   10. Show Work covered by this section and clarify Work furnished by other sections.

D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following indicated below.

B. Roof Edge Flashings and Copings:
   1. ATAS International, Inc: www.atas.com.
   2. Drexel Metals Inc: www.drexmet.com.
   3. Metal-Era Inc: www.metalera.com.
   4. Metal Roofing Systems, Inc: www.metalroofingsystems.biz.
   5. OMG Roofing Products: www.omgroofing.com.
   6. Substitutions: See Section 016000 - Product Requirements.

C. Control and Expansion Joint Covers:
   1. Construction Specialties, Inc: www.c-sgroup.com.
   2. EMSEAL Joint Systems, Ltd: www.emseal.com.
   3. GAF: www.gaf.com.
   4. Johns Manville: www.jm.com.
   5. MM Systems Corp: www.mmsystemscorp.com.
   6. Substitutions: See Section 016000 - Product Requirements.

D. Pipe and Penetration Flashings:
   1. Elmdor Stonemen: www.elmdorstoneman.com.
   2. Portals Plus: www.portalsplus.com.

E. Counterflashings:
   1. ATAS International, Inc: www.atas.com.
   2. Substitutions: See Section 016000 - Product Requirements.

F. Pipe Penetration Wall Seal:
   1. Airex Manufacturing, Inc; Airex Titan Outlet: www.airexmfg.com/.
   2. Substitutions: See Section 016000 - Product Requirements.

G. Pipe Penetration Wall Seal and Insulation Protection System:
   1. Airex Manufacturing, Inc; Airex Pro-System Kit: www.airexmfg.com.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Fascia, cant, and edge securement for roof membrane.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
   3. Color: As indicated on drawings.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
   3. Color: As indicated on drawings.

C. Control and Expansion Joint Covers: Composite construction of 1 inch (25.4 mm) wide flexible EPDM flashing of black color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch (25.4 mm). Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

D. Pipe and Penetration Flashing: Base of galvanized steel, compatible with specified roof systems, and capable of accomodating pipes sized between 3/8 inch (9.5 mm) and 12 inch (305 mm).
   1. Caps: EPDM.
   2. Color: Manufacturer's standard or Contractor's options where concealed from view.
      a. Architect to select from Manufacturer's full range of colors where exposed to view.

E. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

F. Pipe Penetration Wall Seal: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket.
   1. Outlet Cover Color: Match color of adjacent finish.

G. Pipe Penetration Wall Seal and Insulated Piping Protection System: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket and having mechanical line insulation with PVC protective cover.
   1. Outlet Cover Color: Match color of adjacent finish.
   2. PVC Insulation Cover Color: Black with full-length velcro fastener.

2.03 FINISHES

A. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Baked Enamel: Pigmented Organic Coating System, AAMA 2603; polyester baked enamel finish system; color as indicated.

C. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

D. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.04 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

C. Roof Cement: ASTM D4586/D4586M, Type I.
   1. Unless otherwise required for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
   1. Refer to Section 077200 for information on roofing related accessories.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

F. Coordinate installation of flashing flanges into reglets.

END OF SECTION 077100

SECTION 077123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Downspout boots.

B. Gutters and downspouts not specified elsewhere or included with otherwork.
   1. Subject to color and finish requirements indicated on drawings, Contractor may provide formed or manufactured gutters and downspouts for project at Contractor's option.

1.02 RELATED REQUIREMENTS

A. Section 076200 - Sheet Metal Flashing and Trim.
   1. Repair and or replacement of existing gutters and downspouts.
   2. Splashblocks at roof.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2021.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Comply with applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
   1. Include accessories.
   2. Include project-specific details.
   3. Show work to be field-fabricated or field-assembled.
   4. Show interface with other work.
   5. Show all proposed seam and joint locations.
   6. Do not use architect's drawings as shop drawings.
   7. Scale of shop drawing details not less than 1-1/2" = 1'-0".
   8. Show drawings, text and dimensions in black and white at a clear legible scale and size.
   9. Color drawings that are not clearly legible will be returned without review.
   10. Show Work covered by this section and clarify Work furnished by other sections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Gutters and Downspouts:
   1. ATAS International, Inc: www.atas.com.
   2. Cheney Flashing Company: www.cheneyflashing.com.
   3. Drexel Metals Inc: www.drexmet.com.
   4. OMG Roofing Products: www.omgroofing.com.
   5. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc: www.saf.com/persys.
   6. Substitutions: See Section 016000 - Product Requirements.

C. Scupper and Collectors:
   1. Same as or approved by gutter and downspout manufacturer.
      a. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
   1. Finish: Shop pre-coated with modified silicone coating.
   2. Color: As indicated.

B. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick.
   1. Finish: Plain, shop pre-coated with modified silicone coating.
   2. Color: As indicated.

C. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch (0.4 mm) thick; smooth No. 4 finish.

D. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.

2.03 COMPONENTS

A. Gutters: SMACNA square style profile.

B. Downspouts: SMACNA Square profile.

C. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with SMACNA requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

D. Fasteners: Same material and finish as gutters and downspouts , with soft neoprene washers.

2.04 ACCESSORIES

A. Downspout Boots: Cast iron; ASTM A48.
   1. Length: 4'-0".
   2. Type: As required for application.
      a. Architect to select from manufacturer's full range. Design intent is to match metal wall panel color.
   3. Manufacturers:
      a. Downspoutboots.com, a division of J. R. Hoe & Sons; A-Series: www.downspoutboots.com.
      b. Substitutions: See Section 016000 - Product Requirements.

2.05 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated.
   1. Provide 4" x 4" unless more stringent conditiones are indicated on drawings.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal. Hem to face inside, concealed from view.

E. Fabricate gutter and downspout accessories; seal watertight.

2.06 FINISHES

A. Modified silicone polyester coating: Baked enamel system complying with AAMA 2603.

B. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturer's standard colors.
   1. Design intent is to match adjacent color. Provide custom color if manufactuer cannot provide a close match.

C. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters 1/8 inch per foot (3.175 mm/m) .

D. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

END OF SECTION 077123

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SECTION 079100
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precompressed foam seals.

B. Compression gaskets.

C. Preformed strip seals.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Emissions restrictions for joint seal adhesives and primers.

B. Section 079200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.03 REFERENCE STANDARDS

A. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.

B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

C. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements 1991 (Reapproved 2016).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

C. Color Cards: For color selection.

D. Samples for Color Selection: 4 inch (102 mm) long pieces of each color available; at least 2 samples of each color.

E. Volatile Organic Content (VOC) Documentation: For adhesives and primers, submit VOC content and emissions documentation as specified in Section 016116.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least five years of documented experience and approved by manufacturer.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Precompressed Foam Seals:

1. EMSEAL Joint Systems, Ltd: www.emseal.com.
2. Nystrom, Inc: www.nystrom.com.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
4. Substitutions: See Section 016000 - Product Requirements.

C. Compression Gaskets:
1. EMSEAL Joint Systems, Ltd: www.emseal.com.
2. Nystrom, Inc: www.nystrom.com.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
    a. Substitutions: See Section 016000 - Product Requirements.

D. Preformed Strip Seals:
1. EMSEAL Joint Systems, Ltd: www.emseal.com.
2. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
3. Nystrom, Inc: www.nystrom.com.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 PRECOMPRESSED FOAM SEALS

A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, or open-cell polyurethane foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
1. Color: To match adjacent material color.
    a. As selected by Architect.
2. Size as required to provide water-tight seal when installed.
3. Calculate size according to manufacturer's recommendations.
4. Measure size of existing joints before selecting seal width.
5. Applications:
    a. Exterior wall expansion joints.
    b. As indicated.
6. Manufacturers:
    a. EMSEAL Joint Systems, Ltd: www.emseal.com.
    b. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
    c. Nystrom, Inc: www.nystrom.com.
    d. Willseal LLC: www.willseal.com.
    e. Substitutions: See Section 016000 - Product Requirements.

2.03 COMPRESSION GASKETS

A. Compression Gasket: Extruded hollow polychloroprene (neoprene) gasket complying with ASTM D2628; not requiring blockout recess in substrate; not requiring vacuum to collapse seal for installation.
1. Color: Black.
    a. Unless otherwise indicated.
2. Durometer Hardness, Type A: Within 55 to 65, when tested in accordance with ASTM D2240.
3. Size and Shape: As indicated on Drawings.
4. Calculate size in accordance with manufacturer's recommendations.
5. Measure size of existing joints before selecting seal width.
6. Applications:
    a. Exterior wall expansion joints.
    b. As indicated.

B. Compression Gasket: Extruded hollow gasket made of closed cell expanded rubber complying with ASTM D1056, with dense surface skin and serrated sidewalls.
1. Color: Black.
    a. Unless otherwise indicated.
2. Durometer Hardness, Type OO: Within 35 to 65, when tested in accordance with ASTM D2240.

3. Size and Shape: As indicated on drawings.
4. Calculate size in accordance with manufacturer's recommendations.
5. Measure size of existing joints before selecting seal width.
6. Adhesive: Epoxy sealant/adhesive recommended by gasket manufacturer.
7. Applications:
    a. Exterior wall expansion joints.
    b. As indicated.

2.04 PREFORMED STRIP SEALS

A. Preformed Strip Seal: Factory formed profile for adhered application to face of joint substrate.
1. Measure size of existing joints before selecting seal width.
2. Provide compatible materials for application as recommended by manufacturer.
3. Applications:
    a. Exterior wall expansion joints.
    b. Door and window perimeter joints.
    c. As indicated.
4. Manufacturers:
    a. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
    b. EMSEAL Joint Systems, Ltd: www.emseal.com.
    c. Pecora Corporation: www.pecora.com.
    d. Sika Corporation: www.usa-sika.com.
    e. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
    f. Willseal LLC: www.willseal.com.
    g. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Primer: Type recommended by seal manufacturer to suit application; non-staining.

E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Precompressed Foam Seals:
1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion of sealant.

4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

C. Compression Gaskets:
1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion of sealant.
4. Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

D. Preformed Strip Seals:
1. Install when ambient temperature is within recommended application temperature range of adhesive, and consult with manufacturer before installing outside this temperature range.
2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion.
4. When installing over existing non-functioning sealant, remove portions of existing installation that protrude beyond surface; install backing tape on surface of existing sealant installation to prevent adhesion of strip seal.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

END OF SECTION 079100

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 072500 - Weather Barriers: Sealants required onjunction with Air / Moisture Barriers.

C. Section 079100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.

D. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.

C. ASTM C834 - Standard Specification for Latex Sealants 2017.

D. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

E. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2019.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

G. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

I. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).

L. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

M. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

N. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2015.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.

6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
   a. Include name of adjacent material(s).
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.
5. Provide drawing(s) or matrix to clearly indicate locations for each type of sealant. Identify sealants as part of this Section and where included in the Work of another Section.

G. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation as specified in Section 016116.

H. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

I. Installation Plan: Submit at least four weeks prior to start of installation.

J. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

K. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

L. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

M. Installation Log: Submit filled out log for each length or instance of sealant installed.

N. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

O. Manufacturer's Qualification Statement.

P. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience and approved by manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Stain Testing: In accordance with ASTM C1248.
4. Allow sufficient time for testing to avoid delaying the work.

5. Deliver to manufacturer sufficient samples for testing.
6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Installation Plan: Include schedule of sealed joints, including the following.
1. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
2. Installation Log Form: Include the following data fields, with known information filled out.
a. Unique identification of each length or instance of sealant installed.
b. Location on project.
c. Substrates.
d. Sealant used.
e. Stated movement capability of sealant.
f. Primer to be used, or indicate as "No primer" used.
g. Size and actual backing material used.
h. Date of installation.
i. Name of installer.
j. Actual joint width; provide space to indicate maximum and minimum width.
k. Actual joint depth to face of backing material at centerline of joint.
l. Air temperature.

F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
2. Name(s) of sealant manufacturers' field representatives who will be observing
3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
b. Test date.
c. Location on project.
d. Sealant used.
e. Stated movement capability of sealant.
f. Test method used.
g. Date of installation of field sample to be tested.
h. Date of test.
i. Copy of test method documents.
j. Age of sealant upon date of testing.
k. Test results, modeled after the sample form in the test method document.
l. Indicate use of photographic record of test.

G. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
a. For each different sealant and substrate combination, allow for one test every 100 feet (30 meters) in the first 1000 linear feet (305 linear meters), and one test per 1000 linear feet (305 meters) thereafter, or once per floor on each elevation.
b. If any failures occur in the first 1000 linear feet (305 linear meters), continue testing at frequency of one test per 500 linear feet (152 linear meters) at no extra cost to Owner.
4. Field testing agency's qualifications.

5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

H. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

I. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
1. Record results on Field Quality Control Log.
2. Repair failed portions of joints.

J. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch (457 mm) long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25 mm) by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints.

K. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us.
3. Pecora Corporation: www.pecora.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
6. W.R. Meadows, Inc: www.wrmeadows.com.
7. Substitutions: See Section 016000 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
   2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
   3. Pecora Corporation: www.pecora.com.
   4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
   5. W.R. Meadows, Inc: www.wrmeadows.com.
   6. Substitutions: See Section 016000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope: Extent of joint sealants are indicated on drawings.
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
         1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
         2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
      c. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 016116.

B. Colors: As indicated on drawings.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.

2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
4. Color: Match adjacent finished surfaces.
    a. Unless otherwise indicated.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.

C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finish, unless otherwise indicated.

D. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
1. Color: Match adjacent finish, unless otherwise indicated.

E. Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.

F. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
2. Color: Match adjacent finished surfaces.

G. Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.

H. Epoxy Sealant: ASTM C881/C881M, Type I and III, Grade 3, Class B and C; two-component.
1. Hardness Range: 65 to 75, Shore D, when tested in accordance with ASTM C661.
2. Compressive Strength: 11,000 psi (76 MPa), when tested in accordance with ASTM D695.
3. Color: Match adjacent finished surfaces.

I. Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finish, unless otherwise indicated.

J. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Match adjacent finish, unless otherwise indicated, Type OP (opaque).
2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
    a. Unless otherwise indicated.

B. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: Gray.
      a. Unless otherwise indicated.

C. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: Gray.
      a. Unless otherwise indicated.
   4. Tensile Strength: 200 to 250 psi (1.38 to 1.72 MPa) in accordance with ASTM D412.

D. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: Gray.
      a. Unless otherwise indicated.

E. Self-Leveling Silyl-Terminated Polyether/Polyurethane (STPE/STPU) Sealant: ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus and minus 35 percent.
   2. Hardness Range: 30 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: Gray.
      a. Unless otherwise indicated.

F. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
   1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.

G. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
   1. Color: White.
      a. Unless otherwise indicated.

H. High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0 Degrees C (32 Degrees F) meets requirements for low-temperature flexibility.
   1. Color: White.
      a. Unless otherwise indicated.

I. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multi-component, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   3. Color: Concrete gray.
   4. Joint Width, Minimum: 1/8 inch (3 mm).
   5. Joint Width, Maximum: 1/4 inch (6 mm).

J. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
2. Color: Concrete gray.
3. Joint Width, Minimum: 1/8 inch (3 mm).
4. Joint Width, Maximum: 3/4 inch (19 mm).

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.
   1. Profile: As required to match existing metal glazing cap requirements.
   2. Color: As required to match existing conditions.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
   1. Size: 1 inch (25.4 mm) wide, in rolls 100 feet (30.5 m) long.
      a. Unless otherwise indicated or required.
   2. Thickness: 0.78 inch (19.8 mm), with ridges along outside bottom edges for bonding area.
   3. Color: As selected by Architect..

D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.
   1. Size: 1-1/2 inch (38 mm) wide, in rolls 100 feet (30.5 m) long.
      a. Unless otherwise indicated or required.
   2. Thickness: 0.051 inch (1.3 mm), with ridges along outside bottom edges for bonding area.
   3. Color: Light gray.
      a. Unless otherwise indicated or required.

E. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

F. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

G. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

H. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.

3. Arrange for sealant manufacturer's technical representative to be present during tests.
4. Record each test on Preinstallation Adhesion Test Log as indicated.
5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet (30 linear m), notify Architect immediately.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet (300 linear m), notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 079200

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SECTION 099113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Mechanical and Electrical: As indicated on drawings.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
      a. Unless otherwise indicated at existing materials to remain on drawings.
   11. Exterior insulation and finish system (EIFS).
   12. Glass.
   13. Concrete masonry units in utility, mechanical, electrical, and concealed spaces.
   14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 055000 - Metal Fabrications: Shop-primed items.

C. Section 055100 - Metal Stairs: Shop-primed items.

D. Section 078123 - Intumescent Fire Protection.

E. Section 099123 - Interior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2019.

E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

G. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

H. SSPC-SP 6 - Commercial Blast Cleaning 2007.

I. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
   6. Confirmation that top coat is compatible with primer used for steel fabrications.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry and factory finished metals, have been approved.

D. Samples: Submit two paper "draw down" samples, 8-1/2 x 11 inch (216 x 279 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 5 gallons (19 L) of each color and type; from the same product run, store where directed.
   3. Label each container with color, type, and location in addition to the manufacturer's label.
      a. Match paint type designations indicated on drawings for each paint type.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

C. The Contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work. Coordinate all shop and / or field-applied primers with topcoat.

1.07 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 10 feet (3 m) long by 10 feet (3 m) wide, illustrating paint color, texture, and finish.

C. Provide door and frame assembly illustrating paint color, texture, and finish.

D. Locate where directed by Architect.

E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Primer Sealers: Same manufacturer as top coats.

C. Block Fillers: Same manufacturer as top coats.

D. Paints:
   1. Sherwin-Williams Company: www.sherwin-williams.com.
   2. PPG Paints: www.ppgpaints.com.

E. Primer Sealers: Same manufacturer as top coats.

F. Substitutions: See Section 016000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
7. All materials used shall be lead and mercury free.

B. Volatile Organic Compound (VOC) Content: Comply with Section 016116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including .
1. Two top coats and one coat primer.

B. Existing Masonry / Concrete, Opaque Paint System, Latex, 3 Coat:
1. Prepare existing masonry / concrete in accordance with manufacture’s specifications. Verify products to be used with manufacturer's field representative based on project specific conditions.
2. One coat of SW LX2W50, Loxon Concrete & Masonry Primer.
   a. Without existing paint.
3. One Coat of SW LX03W0100, Loxon Acrylic Conditioner.
   a. With existing paint.
4. Flat: Two coats of SW A6-100 Series, A-100 Exterior Latex Flat.
   a. With or without existing paint.
5. One coat of PPG Rhino Grip Primer SPC68000.
   a. With or without existing paint.
6. Flat: Two coats of PPG Rhinocryl Supreme 67101.
   a. With or without existing paint.

C. Concrete & Stucco – Self Cleaning System, Latex, 3 Coat:
1. One coat SW LX2W50, Loxon Concrete & Masonry Primer.
2. Flat: Two coats of SW LX13W51 Loxon Self Cleaning Acrylic.
3. One coat of PPG Rhino Grip Primer SPC68000.
4. Flat: Two coats of PPG Perma-Crete Self-Cleaning Acrylic High Build, A-22XI.

D. CMU, Opaque Waterproofing System, Latex, 3 Coat:
1. One coat SW CF1W50, ConFlex Block Filler.
2. Flat: Two coats of SW CF11W51 Series, ConFlex XL Elastomeric Smooth.
3. One coat of PPG Speedhide Block Filler, 6-15XI.
4. Flat: Two coats of PPG Perma-Crete Pitt-Flex, Elastomeric Smooth, 4-110XI.

E. Ferrous Metals, (doors, frames, & handrails), Primed, Latex, 2 Coat:
1. Touch-up with SW B66-310 Series, Pro-Cryl Universal Water Based Primer.
2. Semi-gloss: Two coats of B53-1150 Series, WB Alkyd Urethane Enamel Semi-Gloss.
3. One coat of PPG Pitt-Tech Plus DTM Primer, 4029 PF.
4. Semi-gloss: Two coats of PPG Pitt-Flex Plus S/G 4216 HP or Speedhide WB Alkyd S/G, 6-1510XI.

F. Galvanized Metals, Latex, 3 Coat:
1. One coat of SW B66-310 Series, Pro-Cryl Universal Water Based Primer.
2. Gloss: Two coats of of B66-600 Series, Pro Industrial Acrylic Gloss.
3. One coat of PPG Pitt-Tech Plus DTM Primer, 4020 PF.
4. Gloss: Two coats of PPG Pitt-Tech Gloss 90-374 or Pitt-Tech Plus Gloss 90-1310.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.
   1. Unless otherwise recommended by manufacturer.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Exterior Plaster and Stucco: 12 percent.
   2. Fiber Cement Siding: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.
   6. Unless otherwise recommended by manufacturer.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi (4140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

I. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

J. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

K. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Asphalt, Creosote, or Bituminous Surfaces: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

M. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

N. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

O. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

P. Copper: Remove contamination by steam, high pressure water, or solvent washing.

Q. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

R. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

S. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

T. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

U. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

V. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

W. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

H. Sand wood and metal surfaces lightly between coats to achieve required finish.

I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

B. Inspect and test questionable coated areas in accordance with Manufacturer's recommendations.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 COLOR SCHEDULE

A. As indicated on drawings.

END OF SECTION 099113

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SECTION 101419
DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

B. Illumination system.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 879 - Electric Sign Components Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
   2. Show locations of electrical service connections.
   3. Include diagrams for power, signal, and control wiring.

D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

E. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:
   1. FASTSIGNS International, Inc; _____: www.fastsigns.com/#sle.
   2. Inpro Corporation; _____: www.inprocorp.com/#sle.
   3. Takeform; ____: www.takeform.net/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.
   1. Use individual fabricated aluminum channel letters, 3 in. thick, translucent acrylic faces letters.
   2. Mounting Location: Exterior as indicated on drawings.

B. Metal Letters:
   1. Material: Aluminum sheet, fabricated reverse channel.
   2. Thickness: 1/8 inch minimum (3 mm).
   3. Letter Height: As indicated on drawings.
   4. Text and Typeface:

a. Character Font: Helvetica, Arial, or other sans serif font.
b. Character Case: Upper case only.

5. Finish: As selected by Architect from manufacturer's full range.
6. Color: As selected.
7. Mounting: Concealed screws.
8. Illumination System: internally lit with rgmw color changing led.
   a. Provide products that are listed and labeled as complying with UL 879, where applicable.
   b. Power: 120 V, 60 Hz, 1 phase, 15 A.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that electrical service is correctly sized and located to accommodate dimensional letter signs.

C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

END OF SECTION 101419

SECTION 101500
VIDEO DISPLAY SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panelized LED Text Only panel display systems.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Support structure.

B. Division 5 – Structural Steel and CFMF: Support framing.

C. Division 26 – Electrical: Power, Conduit, Boxes and Grounding and Bonding for Electrical Systems.

D. Division 27 – Communications: Audio Systems.

E. Section 260526 - Grounding and Bonding for Electrical Systems.

F. Section 260533.13 - Conduit for Electrical Systems.

G. Section 260533.16 - Boxes for Electrical Systems.

H. Section 264113 - Lightning Protection for Structures.

1.03 REFERENCE STANDARDS

A. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification 2013.

B. UL 879 - Electric Sign Components Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least two weeks prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on panelized LED display systems including recommendations for preparation, storage and handling, and installation.

C. Shop Drawings: Indicate cable routing, connections between equipment, anchor and support details, and adjacent construction.
   1. Include equipment weight.
   2. Include new equipment and salvaged equipment, where applicable.
   3. Show installation methods and materials.
   4. Show service points and areas that require access or ventilation. Include clearances, sizes and locations.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Project Record Documents: Provide quantities, type, and location for components, cabling and accessories.

F. System Setting Backup: Provide an electronic file of all system settings.

G. Security Items:
   1. Provide one set of keys for each locked equipment enclosure.
   2. Provide passwords to access control functions for hardware and software user interfaces.

H. Service Agreement: Submit sample of service agreement completed in Owner's name. Refer to Section 1.08 for term.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Authorized Manufacturer Representative: System shall be configured and commissioned by an authorized manufacturer representative.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum ten years of experience.

D. Compatibility: Provide new products that are compatible with Owner's system requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in compliance with manufacturer instructions.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for parts warranty and on-site labor.
   1. Provide guaranteed 12-hour service response from first notification.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Barco, Inc.: www.barco.com/#sle.

B. Daktronics, Inc.: www.daktronics.com/#sle.

C. LG Electronics: www.lg.com/us/business/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 PANELIZED LED VIDEO DISPLAY

A. Performance Requirements:
   1. Comply with performance standards based on tests conducted in accordance with ANSI/Infocomm 10.
   2. Provide products that are listed and labeled as complying with UL 879, where applicable.
   3. Unless more stringent conditions are recommended by manufacturer for application, provide the following:
      a. Extruded Aluminum Cabinets. Finish: As selected from manufacturer's standard line.
      b. FCC Certified.
      c. Back up video processor: Same as main processor.
      d. Fiber transport system.
      e. 20 Modules.
      f. 10 power supplies.
      g. 15 receiving cards.

B. System Type: Flat.
   1. Pixel Pitch: 9.5 mm (10 mm or less).
   2. Horizontal Viewing Angle: 145 degrees.
      a. Unless otherwise recommended by manufacturer for application.
   3. Vertical Viewing Angle: 90 degrees (plus 40 degrees / minus 50 degrees).
      a. Unless otherwise recommended by manufacturer for application.
   4. Brightness: 4000 Nits adjustable.
   5. Mount Type: Free Standing/Self Supporting.
   6. Location: Outdoor.
   7. Size: As indicated on drawings.
   8. Panel Depth: 4.96 inches (126 mm) maximum.
   9. Service Access: Front or Front/Rear.

2.03 CONTROLS

A. Interface Unit:
   1. With the following abilities; scale media, rotate media, adjust brightness, loop output, input selection, and recommended by manufacturer for application.

2. Input source supports DVI, HDMI, PC, VGA, S-Video, and recommended by manufacturer for application.
3. Output to Cat5.
4. Working Voltage: 120 VAC single phase.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and support structure is in place and properly prepared.

B. Verify that required power and data sources are provided.

C. Verify that space is available for centrally located components.

D. Notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result under the project conditions.

B. Do not proceed with installation until support structure and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions .

B. Install message center and signs level and plumb with fasteners reccommended by the manufacturer.

C. Custom Mounting: Coordinate with support structure specified in 055000 and indicated on drawings for mounting and support.

D. Record any necessary changes to the system design.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation and maintenance of equipment to Owner's designated representative.

D. Review service and support contacts.

E. Service Agreement: Provide onsite supervision by technician for each home game or event for two years from the date of Substantial Completion.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 101500

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SECTION 129300
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Benches.

B. Bike Racks.

C. Bollards.

D. Waste Receptacles.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: For product footings.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' specifications and descriptive literature, installation instructions, and maintenance information.

C. Shop Drawings: Provide manufacturer details for product for approval, prior to fabrication.

D. Samples: Submit manufacturer's available colors and finishes for each material type.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s requirements.

B. Transport, store, and handle units in an upright position, avoiding rubbing, scratching, or dragging of unit base on concrete or substrate.

C. Remove pallet/crate strapping and wrapping upon delivery of units to site to avoid marring of surface finish, unless stored in an interior, enclosed storage space free from moisture and excessive heat.

D. Use equipment and methods for transportation, site handling and installation as recommended by manufacturer.

E. Storage:
   1. Store units off ground, preferably on a wood pallet, and in manner to prevent physical damage, including rubbing, scratching, or denting of finished surface.
   2. Place stored units in a singular upright position and according to manufacturer specifications.
   3. Store so that singular units are accessible and undamaged.

F. Handle products with care to prevent any damage to surface finish.

PART 2 PRODUCTS

2.01 BENCHES

A. Manufactured by: Commercial SIte Furnishings; https://www.commercialsitefurnishings.com; or approved equal.
   1. Model RF96-PERF
      a. 8' perforated steel bench
      b. Finish to match existing bench.
      c. Surface mount per manufacturer's requirements.

1) Mounting hardware: non-corrosive tri-groove anti-theft type; bolt cut flush with the nut.

2.02 BIKE RACKS

A. Manufactured by: DuMor; http://dumor.com; or approved equal.
   1. Model 291-00/ S-1
      a. Powder coated bike rack for embedment mount.
      b. Finish as selected by Architect from manufacturer's full range.
      c. S-1 embedment mount per manufacturer's requirements.

2.03 BOLLARDS

A. Manufactured by: Iron Age Grates.; https://www.ironagegrates.com/; or approved equal.
   1. Needle Model
      a. 34" x 4.9"
      b. Cast Aluminum; powder coat finish.
      c. Finish as selected by Architect from manufacturer's full range.
      d. Embed Mount
         1) Anchor and install per manufacturer's requirements.

2.04 WASTE RECEPTACLES

A. Manufactured by: DuMor; http://dumor.com; or approved equal.
   1. Model 438-32
      a. 32 gallon steel receptacle
      b. FTO cover
      c. Steel frame
      d. Finish: as selected by Architect from manufacturer's full range.
      e. Surface Mount per manufacturer's requirements.
         1) Mounting hardware: non-corrosive tri-groove anti-theft type; bolt cut flush with the nut.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine deliveries upon arrival at site to verify each unit is without damage.
   1. Replace damaged units.

B. Verify that mounting surfaces, preinstalled anchor bolts, or other mounting devices are properly installed; and ready to receive site furnishing items.

C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

B. Provide level mounting surfaces for site furnishing items.
   1. Set units level, plumb, square and true within allowable tolerances.

3.03 ADJUSTING

A. Adjust each system so that sectional units are in proper location and orientation.

B. Holes cannot be added to units in the field and must be fabricated during manufacturing process, prior to finishing of units.

3.04 CLEANING

A. Clean dirt or blemishes from surface of exposed units.

B. Wash and rinse in accordance with manufacturer’s recommendations.

C. Protect adjacent surfaces from damage due to cleaning operations.

D. Do not use cleaning materials or processes which could alter character of exposed finishes.

END OF SECTION 129300

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TULSA

PUBLIC SCHOOLS

260400
Electrical Systems

SECTION 260400 - ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included: Provide Design, Engineering and Construction Documents incorporating the Owner's Guidelines and Specifications defined herein, with proper installation of materials, assemblies and equipment including, but not limited to:
   1. Basic Materials and Methods.
   2. Control-Voltage Electrical Power Cables
   3. Low-Voltage Electrical Power Conductors and Cables.
   4. Grounding and Bonding.
   5. Hangers and Supports.
   6. Raceways and Boxes.
   7. Handholes And Boxes for Exterior Underground Wiring.
   8. Sleeve-Seal Systems for Electrical Raceways
   9. Lighting Control Devices.
   10. Wiring Devices.
   11. Fuses.
   12. Enclosed Switches and Circuit Breakers.
   13. Interior and Exterior Lighting.
   14. Other items and services required to complete the systems.

B. Drawings:
   1. These Design Guidelines and Specifications are accompanied by floor plans of the building showing the general location of the work. Exact locations shall be subject to the approval of the Owner who reserves the right to make any reasonable changes in locations indicated, prior to rough-in, without cost to the Owner. While the general run of feeders, branches, and conduits are indicated on the Drawings, it is not intended that the exact routing of circuits or locations of conduits be determined by Conceptual Drawings. Detailed arrangements of all Work shall be subject to the Owner's approval.

C. Related Work:
   1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

D. Temporary Power:
   1. Arrange, provide and pay for the costs of installing temporary power to the site in accordance with the requirements of Division 1.

1.2 QUALITY ASSURANCE:

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Codes and Ordinances:
   1. The installation shall comply with requirements of all applicable laws, codes and ordinances including those of the state, county and city.
   2. NFPA 70 - 2014.
   3. NFPA 72 – 2015 (including FM Directives)
   4. NFPA 101 – 2014.
   5. Where these Drawings, Design Guidelines and Specifications show more stringent requirements than required codes, the more stringent shall prevail.
   6. The Work shall comply with current standards of the serving utility companies.

C. Permits, Fees and Licenses:
   1. The Contractor shall obtain and pay for all permits, fees and licenses, for Work required under these Specifications.

D. Utility Company Fees:
   1. Coordination of existing utilities and easements including fees associated with the project shall be included in the Work.

E. Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.3 EXAMINATION OF SITE:

A. Visit the site, inspect the existing conditions and check the Drawings and Specifications to be fully informed of the requirements for completion of the Work.

B. Lack of such examination shall not justify a request for extra compensation to the Contract price.

1.4 MATERIAL AND EQUIPMENT:

1.5 SUBMITTALS:

A. SHOP DRAWINGS AND SUBMITTAL DATA
   1. Process shop drawings and submittal data to ensure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

a. Shop drawings shall be drawn on a scale not less than ¼ inch equals 1 foot showing actual dimensions. Shop drawings shall include, but not be limited to:
   1) Switchboards
   2) Distribution Panelboards

2. Submittal data (manufacturer's catalog data) shall include Manufacturer's Specifications, product literature and other data needed to demonstrate compliance with the specified requirements, but not be limited to the following:
   a. Equipment: Disconnect Switches, Circuit Breakers, Fuses, etc.
   b. Materials: conduit, conductors, connectors, supports, etc.
   c. Lighting Fixtures and Lamps.
   d. Wiring Devices.
   e. Lighting Control Devices – Sensors, Dimming, etc.
   f. Low-Voltage Data outlet devices and Cabling systems.
   g. Low-Voltage Clock and Intercom System – (Existing).
   h. Security and Camera Systems – (Existing)
   i. Addressable Fire Alarm System – (Existing).
3. Manufacturer's recommended installation procedure which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the work.
4. The submittal data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.
5. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.
6. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.
7. The Contractor shall submit shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner. Shop drawings shall be prepared at a scale of not less than ¼ inch equals 1 foot.

B. SUBSTITUTIONS
1. Where a single manufacturer is mentioned by trade name or manufacturer's name, it has been done to establish a standard rather than to discriminate against an equal product made by another manufacturer.
2. Where multiple manufacturers are listed in the Owner’s drawings and/or specification, none other than those manufacturers will be accepted.
3. Substitute manufacturers will be considered prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation" or "alternate". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

4. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
5. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
6. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal ¼ inch equals 1-foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
7. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
8. The Owner reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
9. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

C. Samples:
   1. When requested by the Owner, promptly provide samples of items scheduled to be exposed in the final structure.
   2. When specifically, so requested by the Contractor and approved by the Owner, approved samples will be returned to the Contractor for installation on the Work.

D. Record Drawings:
   1. Comply with pertinent provisions of Division 1.
   2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below.

E. Manual:
   1. Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver the operation and maintenance manual to the Owner complied in accordance with the provisions of Division 1 of these specifications. Include within each manual.
      a. Copy of the approved Record Documents for this portion of the Work.
      b. Copy of each circuit directories.
      c. Copy of each warranty and guaranty.

1.6 GUARANTEE:

A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.

B. Upon written notice from the Owner or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.7 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturers' standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Owner at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall be not less than one (1) year.

PART 2 - PRODUCTS

2.1 BASIC ELECTRICAL MATERIALS AND METHODS:

A. Provide only materials that are new and of the type and quality specified. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.

B. Materials and equipment shall be new, of the same type and manufacturer, of the best quality and design, free from defects and meet the requirements of UL and NFPA where standards are established for those items and assemblies.

C. Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

D. Manufacturer's name and model number used herein and, on the Drawings, establish type and quality required. Equal products may be considered if submitted in writing to the Owner's Representative for approval 10 (ten) days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.

E. Fire stopping material shall be 3M Fire Seal Caulking, or approved substitution.

F. Terminals and enclosures shall be marked for 75° C operation or conductor size shall be increased as required at no cost to the Owner.

G. Steel Pipe Wall Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends. Comply with NECA 1.

H. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and roof manufacturer's requirements.

I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

J. Provide sleeves and chases where conduits pass through rated floors and walls, fire stopped in accordance with UL Listed assembly.

K. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Owner.

L. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

M. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

N. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

O. Service voltage and color codes for 480Y/277V: Phase A - Brown, Phase B - Orange, Phase C – Yellow, Neutral – White, and Ground - Green.

P. Service voltage and color codes for 208/120V: Phase A - Black, Phase B - Red, Phase C – Blue, Neutral – White, and Ground - Green.

2.2 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

A. Related Requirements:

1. Section 260400 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

B. Copper Building Wire: Flexible, insulated and uninsulated, drawn copper current-carrying conductor complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Basis-of-Design Product: Subject to compliance with requirements, provide Southwire Company or comparable product by one of the following:
1. Alpha Wire Company.
2. Cerro Wire LLC.

3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Southwire Company.

D. Service Entrance Conductors:
1. For line voltages, provide 600 V THHN insulated copper wire with UL Label, listing, and color coded for voltage.

E. Conductors:
1. For line voltages, provide 600 V insulated copper wire and cable, with UL Label, listing, and color coded for voltage.
2. Use type THHN/THWN color coded for voltage at interior, type THHN/THWN-2 for exterior.
3. For wire No. 10 and smaller, provide solid wire: for wire larger than No. 10, provide stranded wire.
4. Conductors No. 8 and larger, provide insulating bushings or insulating sleeves.
5. Use only copper wires and cables.

F. No. 12 AWG THHN conductors and larger for all branch circuits, protected by 20-amp circuit breakers. Where so indicated on the Drawings, by actual load, or by the N.E.C., use larger wires to limit voltage drops:
1. Increase wire sizes to next largest AWG size for:
   a. 120-volt circuits exceeding 150 feet in circuit length.
   b. 208-volt circuits exceeding 200 feet in circuit length.
2. Wire and conduit sizes shall be increased for the above conditions whether shown on the Drawings or not.

G. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.

H. Make splices electrically and mechanically secure with pressure-type. Push-in connectors shall not be allowed.
1. For wires size 10 AWG and smaller, provide NSI twist-on connectors.
2. For wires size 8 AWG and larger, provide NSI Polaris insulated connectors.

I. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with the friction tape or the vinyl-plastic electrical tape specified above.

2.3 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Related Requirements:

1. Section 260400 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

B. Copper Building Wire: Flexible, insulated and uninsulated, drawn copper current-carrying conductor complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Basis-of-Design Product: Subject to compliance with requirements, provide Southwire Company or comparable product by one of the following:
   1. Alpha Wire Company.
   2. Cerro Wire LLC.
   3. Encore Wire Corporation.
   4. General Cable Technologies Corporation.
   5. Southwire Company.

D. Conductors:
   1. For line voltages, provide 600 V insulated copper wire and cable, with UL Label, listing, and color coded for voltage.
   2. Use type THHN/THWN color coded for voltage at interior, type THHN/THWN-2 for exterior.
   3. For wire No. 10 and smaller, provide solid wire: for wire larger than No. 10, provide stranded wire.
   4. Conductors No. 8 and larger, provide insulating bushings or insulating sleeves.
   5. Use only copper wires and cables.

E. No. 12 AWG THHN conductors and larger for all branch circuits, protected by 20-amp circuit breakers. Where so indicated on the Drawings, by actual load, or by the N.E.C., use larger wires to limit voltage drops:
   1. Increase wire sizes to next largest AWG size for:
      a. 120-volt circuits exceeding 150 feet in circuit length.
      b. 208-volt circuits exceeding 200 feet in circuit length.
   2. Wire and conduit sizes shall be increased for the above conditions whether shown on the Drawings or not.

F. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.

G. Make splices electrically and mechanically secure with pressure-type. Push-in connectors shall not be allowed.
   1. For wires size 10 AWG and smaller, provide NSI twist-on connectors.
   2. For wires size 8 AWG and larger, provide NSI Polaris insulated connectors.

H. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with the friction tape or the vinyl-plastic electrical tape specified above.

2.4 GROUNDING AND BONDING

A. Submittals:
   1. Product Data: For each type of product.
   2. Product Schedule: Indicate type, use, location, and termination locations.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Burndy; Part of Hubbell Electrical Systems.
   2. ERICO International Corporation.

3. TE Connectivity Ltd.
4. ILSCO.
5. O-Z/Gedney; a brand of Emerson Industrial Automation.

C. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

D. Bare Copper Conductors:
1. Stranded Conductors: ASTM B 8.
2. Tinned Conductors: ASTM B 33.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

E. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

F. Connectors: Listed and labeled by an NRTL as complying with NFPA 70, acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 467.
1. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
2. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
3. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
4. Cable-to-Cable Connectors: Compression type, copper or electroplated tinned copper, C and H shaped.
5. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
6. Conduit Hubs: Mechanical type, terminal with threaded hub.
7. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
8. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
9. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
10. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
11. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
12. Water Pipe Clamps: Tin-plated aluminum or Silicon Bronze. Mechanical type, two pieces with zinc-plated bolts.

G. Provide exothermic connections with Erico/Cadweld or approved substitutes.

H. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches.

I. Bond all water piping systems per local codes. Do not bond to gas piping systems within the building.

2.5 HANGERS AND SUPPORTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Material: Pre-galvanized steel.
   2. Channel Width: 1-5/8 inches.
   3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. B-line, an Eaton business.
      b. Empire Tool and Manufacturing Co., Inc.
      c. Hilti, Inc.
      d. MKT Fastening, LLC.
   2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   4. Toggle Bolts: All-steel springhead type.
   5. Hanger Rods: Threaded steel.

F. Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

G. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter. Wire-ties and zip-ties shall not be an acceptable means of support to structure(s).

H. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

I. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

J. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

K. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

L. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2.6 RACEWAYS AND BOXES

A. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

B. Raceways and Fittings:
1. Steel Electrical Intermediate Metal Conduit (IMC) - UL 1242 and UL Category Control Number DYBY: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
2. Steel Electrical Metal Tubing (EMT) and Elbows: UL 797 and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
3. Aluminum Electrical Metal Tubing (EMT) and Elbows: UL 797A and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
4. Flexible Metal Conduit (FMC): Steel_Aluminum. UL 1 and UL Category Control Number DXUZ. Fitting: UL 514B and UL Category Control Number ILNR.

5. Liquidtight Flexible Metal Conduit (LFMC): Steel_Aluminum. UL 360 and UL Category Control Number DXHR. UL 514B and UL Category Control Number DXAS.
6. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings: UL 651 and UL Category Control Number DZYR. For use with maximum 90 deg C wire.
7. Minimum raceway size: 3/4" raceway for power circuits and 1" raceways for low-voltage communication cable raceways.

C. Surface mounted raceways: Wiremold or Owner approved equal, steel 500 or 700 Series with matching surface mount box and mounting accessories. Color as directed by Owner. EMT conduit is not an allowable method for surface raceways. Submit to Owner prior to installation.

D. Surface mounted raceways on existing walls: 3/4" EMT maximum. Provide 1/2" EMT raceways for thermostat, HVAC sensors and control circuits anchored to wall system by approved method.

E. Boxes, Enclosures and Cabinets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse-Hinds, an Eaton business.
   b. Hubbell Incorporated.
   c. RACO; Hubbell.
   d. Thomas & Betts Corporation; A Member of the ABB Group.
   e. Wiremold / Legrand.
2. General Requirements for Boxes, Enclosures, and Cabinets: Comply with NFPA 70 for intended location and use. UL 514A and UL CCN QCIT.
3. Wireways and Auxiliary Gutters:
   a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system. Manufacturer's standard enamel finish.
   b. Wireway Covers: Hinged, Screw-cover and Flanged-gasketed as indicated in drawings.
4. Metallic Outlet, Device Boxes, Rings, Covers and Conduit Bodies:
   a. Description: 4" square outlet box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
   b. Material: Sheet steel and Cast metal.
   c. Sheet Metal Depth: 2-1/8" deep minimum to accommodate 1" knockout.
   d. Cast-Metal Depth: 2.4 inch deep.
   e. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing 50 lb.
   f. Paddle Fan and Large Luminaire Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.
   g. Conduit Bodies: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point.

5. Metallic Floor Boxes and Floor Box Covers: RFB4 series with (4) independent compartments, stamped steel, and shallow steel for concrete 2 7/16" depths accepting 3/4" and 1" conduit.
   a. Coverplates shall be scrub-proof with carpet in-lay and easy open handle. Activate all compartments with specified and approved wiring devices.
6. Nonmetallic Outlet, Conduit Bodies and Device Boxes: UL 514C and UL CCN QCMZ.

F. Termination Boxes: UL 1773 and UL Category Control Number XCKT.
1. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
2. Listed and labeled for installation on line or load side of service equipment.

G. Cabinets, Cutout Boxes, Junction Boxes and Pull Boxes: UL 50 and 50E.
1. Sheet Metal Cabinets:
   a. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung. UL Category Control Number CYIV.
2. Sheet Metal Cutout Boxes:
   a. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
3. Sheet Metal, Cast-Metal, and Polymeric Junction and Pull Boxes:
   a. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable. UL Category Control Number BGUZ.

H. Cover Plates for Devices Boxes: UL 514D and UL Category Control Numbers QCIT and QCMZ.
1. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
2. Cover Plates for Device Boxes:
   a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
   b. Metallic Wallplate Material: 0.032-inch-thick Type 302/304 non-magnetic stainless steel with brushed finish.
   c. Metallic Wallplate Material: Steel with white baked enamel, suitable for field painting.
   d. Metallic Wallplate Material: Galvanized steel.
   e. Metallic Wallplate Material: As indicated on architectural Drawings.
   f. Nonmetallic Wallplate Material: 0.060 inch thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
   g. Color: As indicated on architectural drawings or selected by Owner/Architect.
3. Hoods for Outlet Boxes:
   a. Reference Standards:
      1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
   b. Mounts to box using fasteners different from wiring device.
4. provide galvanized code-gauge sheet steel units with screwed-on covers, of size and shape required to accommodate wires without crowding, and to suit the

location. Mark with permanent ink circuit designations on cover plate. If box is to be painted provide permanent ink marking on inside of box cover.

5. For exterior pull boxes, provide fiberglass quazite box with sealed lid identified "ELECTRICAL" at size required to accommodate wires at 40% fill.
6. Provide sleeves and chases where conduits pass through floors and walls, fire-stopped in accordance with NEC Article 300.21.
7. For switches and receptacles, provide standard ganged switch boxes with plastic or stainless-steel covers as required by Architect; except for exposed Work, provide pressed steel boxes with galvanized or cadmium plated steel covers.
    a. For telephone/communication outlets, provide 4" square boxes with single device cover. Route conduit to accessible ceiling cavity with end bushings and nylon pullstring.

I. Junction boxes may not be installed back-to-back in walls and partitions. Consult with Owner for proper separation of boxes (typically, 12" in non-rated walls, 24" in rated walls).

J. Securely and rigidly support boxes to super structure throughout the Work.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Armorcast Products Company.
    b. NewBasis.
    c. Oldcastle Enclosure Solutions.
    d. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SLEEVE-SEAL SYSTEMS FOR ELECTRICAL RACEWAYS

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:
   1. Material: Galvanized sheet steel.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

D. SLEEVE-SEAL SYSTEMS
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
   2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Carbon steel.
   4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

E. SLEEVE-SEAL FITTINGS
   1. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
         1) HOLDRITE.
         2) Presealed Systems.

F. GROUT
   1. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
   2. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
   3. Design Mix: 5000-psi, 28-day compressive strength.

G. SILICONE SEALANTS
1. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. A Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

2.9 LIGHTING CONTROL DEVICES:

A. Occupancy Sensors and Presence Detection:
1. Ceiling mounted in Classrooms: STEINEL: 64470 IR QUATTRO HD COM2-24.
2. Ceiling mounted in Corridors: STEINEL: 64560 US HALLWAY COM2-24.
3. Ceiling mounted in Restrooms: STEINEL: 64700 DT QUATTRO COM1-24.
4. Manufacturer part numbers change and must be verified prior to work.

B. Wall Dimmers/Occupancy/Vacancy Sensors:
1. LEVITON: DS710-10Z, Locations may vary, final by Owner.

C. Photocells: Integral with egress exterior fixtures.

D. Provide and install time clocks for automatic operation of lighting and equipment loads in accordance with the Time Clock Schedule shown on the Drawings, and as follows:
1. Equipment Control:
a. Tork W-220-L, SPST, reserve power, 40 AMP contacts, NEMA 1 surface mounted enclosure.
b. Lighting Control:
1) Tork 7200ZL, DPST, reserve power, 40 AMP contacts, astronomic dial, NEMA 1 surface mounted enclosure.
c. Photocell:
1) Tork 2101, SPST, 2000 Watt rating, 120 Volt.

2.10 WIRING DEVICES:

A. UL Listed and labeled as defined in NFPA 70.

B. Color of wiring devices shall match existing facility devices or per Owner’s requirements. Color of isolated ground receptacles to be orange. Coordinate with Architect/Owner for final color of all devices.

C. Duplex Convenience Receptacles: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

D. Twist-Locking Receptacles: Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration Heavy-duty, NEMA 5-20R, and UL 498.

E. GFCI Receptacles: 125 V, 20 A, straight blade, 20 A feed-through type. Comply with NEMA WD 1, Heavy-duty NEMA 5-20R, UL CCN KCXX, UL 498, UL 943 Class A, and FS W-C-596.
   1. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
   2. Self-testing technology with indicators including disconnecting power if damaged.
   3. Receptacles shall be side wired feed-thru.

F. Tamper-Resistant Duplex Straight-Blade Receptacle: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596.

G. Tamper-Resistant Duplex Straight-Blade Receptacle with USB Outlet to Power Class 2 Equipment: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596.

H. Duplex Straight-Blade Receptacle with Type 3 Surge Protective Device: 125 V, 20 A: Comply with color BLUE per NEMA WD 1, heavy-duty. Configuration NEMA 5-20R, UL 498, and FS W-C-596.

I. Pendant Cord-Connector Devices:
   1. Matching, locking type plug and receptacle body connector.
   2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
   3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
   4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

J. Cord And Plug Sets:
   1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
   3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

K. Toggle Switches: Comply with NEMA WD 1, UL 20, and FS W-S-896. Commercial-industrial type, 20 amp, 120/277 V AC, from the following:
   1. Single Pole:
      a. Cooper; AH1221.
      b. Hubbell; HBL1221.
      c. Leviton; 1221-2.
      d. Pass & Seymour; CSB20AC1.
   2. Two Pole:
      a. Cooper; AH1222.
      b. Hubbell; HBL1222.
      c. Leviton; 1222-2.
      d. Pass & Seymour; CSB20AC2.

3. Three Way:
    a. Cooper; AH1223.
    b. Hubbell; HBL1223.
    c. Leviton; 1223-2.
    d. Pass & Seymour; CSB20AC3.
4. Four Way:
    a. Cooper; AH1224.
    b. Hubbell; HBL1224.
    c. Leviton; 1224-2.
    d. Pass & Seymour; CSB20AC4.

L. Cover plates for flush mounted receptacles and switches:
1. Mechanical, utility, kitchen and Exterior: provide 0.040" stainless steel cover plates in all areas and all devices.
2. Office and classroom areas: Provide 0.040" stainless steel cover plates. Plastic cover plates matching the wiring devices specified for millwork.
3. Where wiring devices are grouped, set in gangs with one cover plate.
4. Where wiring devices are noted to be weatherproof, provide cast cover, gasketed & hinged, while-in-use rated and lockable cover.
5. Use jumbo size plates, 302 stainless steel for outlets installed in masonry walls or as specified by Owner and existing facility standard installation.

M. Manual motor starter: Square D "Class 2510" for 120V, 1ph motors.

N. Communication Outlets:
1. CommScope is Owner Standardized Equipment.
2. Terminate each data outlet listed in drawings with one blue CommScope Cat 6 snap in jack. Use the TIA/EIA T568-A/B termination method. Provide blanks as necessary to fill all unused positions of the outlet. Snap-in jacks to accommodate UTP, fiber optic, and coaxial connectors were indicated on drawings.
3. Surface Mounted Data Outlets: Provide raceway #LD10E16-A to metal junction box #JBX3510EI-A. Color by Owner.

2.11 FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bussmann, an Eaton business.
2. Edison; a brand of Bussmann by Eaton.
3. Littelfuse, Inc

B. CARTRIDGE FUSES
1. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
    a. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
    b. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
    c. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting, time delay.
    d. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.

2. 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.
3. Comply with NEMA FU 1 for cartridge fuses.
4. Comply with NFPA 70.
5. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.12 ENCLOSED SWITCHES AND CIRCUIT BREAKERS:

A. Provide safety and fused switches, horsepower rated, quick-make and quick-break design, externally operated with provision for padlocking in "OFF" position, fusible or non-fusible as shown on the Drawings. Cartridge to accommodate Class R fuses.

B. Provide enclosures clearly marked for maximum voltage, current, and horsepower rating, and:

1.	Indoor:	General Duty, NEMA Type 1
2.	Outdoor:	Heavy Duty, NEMA Type 3R, Rain-tight
3.	Kitchen Wash-down areas:	Heavy Duty, NEMA Type 4x

C. For switches having dual ratings (higher rating when used with dual-element fuses), provide ratings indicated on a metal plate riveted or otherwise, or permanently fastened to the enclosure.

D. For switches serving equipment with multiple motors, switches shall be fused as indicated on the equipment nameplate.

2.13 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. LED TROFFER - MANUFACTURERS
1. Pre-Approved Manufacturers Listed: Products of firms regularly engaged in the manufacture of recessed LED lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping. Provisions for a single fixture shipped to the project site shall become property of the Owner to test and evaluate the construction meets or exceeds the original fixture approved by the Owner and listed in the fixture schedule.
2. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.
3. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.
4. UL or CSA US Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the “Standards for Safety" to UL 8750 or others as they may be applicable. A listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.

5. Luminaire Flat Panel Edge Lit shall be DLC Premium Certified (Design Lights Consortium).
6. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary for the work.
7. Base Bid Manufacturers: Are listed on fixture schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards and photometric distribution set by the specified product.
8. Alternate Manufacturers: Identification by means of manufacturers names and catalog numbers is to establish basic features, quality and performance standards. Any substitutions must meet or exceed these standards. The three listed manufacturers are pre-approved Owner's standard fixtures and substitution request may not be allowed prior to bid.

B. LED LUMINAIRE SOURCE REQUIREMENTS

1. LED's shall be manufactured by, Nichia, Cree, Samsung or Osram.
2. Lumen Output – minimum initial lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-90-degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
3. Type 2x4: 40 Watt, Efficacy (lm/W) >123 @ 5000K for ceilings up to 10'-0".
4. Type 2x4: 48 Watt, Efficacy (lm/W) >124 @ 5000K for ceilings 10'-1" to 12'-0".
5. Type 2x2: 30 Watt, Efficacy (lm/W) >121 @ 5000K for ceilings up to 10'-0".
6. Type 2x2: 40 Watt, Efficacy (lm/W) >119 @ 5000K for ceilings 10'-1" to 12'-0".
7. 4-Ft Strip: 45 Watt, Efficacy (lm/W) >128 @ 5000K.
8. Recessed Fixtures: Comply with NEMA LE 4.
9. Provide adjustable Kelvin Rating drivers for fixtures located in Special Education Classrooms. Provide manufacturer specified wall switch.
10. Rated lamp life of 50,000 hours. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours.
11. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
12. LED Boards shall be suitable for field maintenance or replacement with plug-in connectors at power supply/drive.
13. Light Color/Quality:
14. Correlated Color temperature (CCT) range as per specification, luminaire sources and 5000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2- D CIE chromaticity chart.
15. The color rendition index (CRI) shall be 82 or greater.
16. Chromaticity shift over 6,000 hours shall be <0.007 change in delta-u'v' average as demonstrated data set in IESNA LM-80-08 report.
17. Lumen Maintenance Factor: >0.84 at 25°C, 50,000 hours and reported in TM-21 L70 Lifetime >60,000 hours.
18. Binning: Per ANSI, 3-step MacAdam ellipse with abilities to produce uniform color across copious quantities of fixtures.

C. LED LUMINAIRE POWER SUPPLY AND DRIVE REQUIREMENTS

1. Driver: Instant start. 120 – 277 Volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 85% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
2. Flat Panel Edge-lit LED: The electronics/power supply enclosure shall be external to the SSL luminaire and be accessible per UL requirements.
3. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output with a smooth shut off function. Dimming shall be controlled by a 0-10V signal. Signal wires shall be 22 AWG solid copper minimum.
4. Compatible with Leviton dimming device(s): DS710-10Z or equal.
5. Electrical Characteristics:
6. Power Factor: >0.93.
7. Input Power: 120-277V, 50/60 Hz.
8. Total Harmonic Distortion (THD): <20%.
9. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.
10. Material Usage: Drivers shall be (ROHS)-compliant.
11. Warranty: Five (5) years.

D. LED FLAT PANEL CONSTRUCTION

1. Frame: LED strips mounted on edges enclosed in solid extruded aluminum frame, painted after formed with UV-stabilized acrylic optical lens with a full aluminum back. Construction seals conditioned air from the plenum or non-conditioned air. Housing shall be designed rigid to eliminate warping or bending for level installation. Frame corners conformed for seamless appearance.
2. Optical Lens/Diffusers:
3. Acrylic: One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.
5. Each luminaire shall be designed to operate at an average operating temperature -4°F to 104°F.
6. Humidity: 20% – 85% RH, Lighting Facts.
7. Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED’s or plastic supports in viewing angles at floor to ceiling placement.
8. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be fundamental to the unit.
9. Driver disconnect shall be provided where required to comply with codes.
10. Finish: Polyester white powder coat painted with 92% high-reflective paint after fabrication.
11. Integral Grid Clips required on recessed mounted luminaires along with integral tie wire mounting points. Compatible with standard 15/16” and 9/16” T-Bar ceilings.
12. Luminaire to have air removal capability where specified.

13. Any questions shall be directed to Randy Ramsey in the Bond office of TPS. Office: 918-746-6131 or E-mail: ramsera@tulsaschools.org
14. NOTE: As new technologies become available this specification will be changed. Do not assume you have the latest spec, ask for the most recent revised specification from Tulsa Public Schools bond office.

E. RECESSED LED DOWNLIGHTS
1. An approved manufacturer same as LED troffers or equal. 4000K minimum.
2. Housing finish to be white unless otherwise specified
3. Must be able to accept an actual lensed R-30 LED, with Edison medium base.

F. EXIT SIGNS:
1. Comply with LM80 and with authorities having jurisdiction for sign colors and lettering size, and with be LED illuminated
2. Internally Lighted Signs: As follows:
3. Lamps for AC Operations: Light-emitting diodes, 50,000 hours minimum rated lamp life
4. Self-Powered Exit Signs (Battery Type)" Integral automatic charger in a self-contained power pack.
5. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty
6. Charger: Fully automatic, solid-state type with sealed transfer relay.
7. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

G. EMERGENCY LIGHTING UNITS:

1. Self-contained units Comply with UL 924/LM 80. Units include the following features:
   a. Battery: Sealed, maintenance-free nickel - cadmium type with minimum 10-year nominal life and special warranty.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level when normal voltage is restored, relay disconnects lamps and batter is automatically recharged and floated on charger.

H. EMERGENCY LED POWER SUPPLY UNIT:

1. Self-contained, modular, battery-inverter unit factory mounted within fixture body-comply with UL 924/LM 80.
2. Test Switch and light-emitting diode indicate light: Visible and accessible without opening fixture or entering ceiling space.
3. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal

voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

6. Do not support from sub-purloins of panelized roof systems.

PART 3 - EXECUTION

3.1 ELECTRICAL SITE COORDINATION AND PREPARATION

A. Examine the areas and the Conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate with local utility company temporary and permanent power requirements for the project. Provide a request for all utilities to be located and marked at project site prior to the start of Work. Prepare site easements for saw-cutting, trenching and backfill. Coordinate power outages with Owner and utility company 10-days prior to outage.

C. Coordination with Division Trades:

1. Coordinate as necessary with other trades to assure proper and adequate provision in this Work of those trades for interface with the Work of this Section.
2. Coordinate the installation of electrical items with the schedule for Work of other trades to prevent unnecessary delays in the total Work.
3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
4. Provide 110-volt temperature control, control transformers in enclosures and interlock wiring. Coordinate all requirements with mechanical contractor prior to rough-in and installation.
5. Provide weatherproof ground-fault receptacles within 25’-0” of devices and equipment to be readily-accessible for maintenance.

D. Coordinate arrangement, mounting and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. Provide for ease of disconnecting the equipment with minimum interference to other equipment installations.
3. Allow right-of-way for piping and conduit installed at required slope.
4. Connecting raceways, cables, wireways, cable trays and busways to be clear of obstructions and allow working clearances of other equipment.

E. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Architect. Where outlets are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.

F. The Electrical Drawings are diagrammatic but are required to be followed as closely as actual construction and Work of other trades will permit. Where deviations are required to conform with actual construction and the Work of other trades, make such deviations without additional cost to the Owner.

3.2 INSTALLATION OF CONTROL-VOLTAGE ELECTRICAL POWER CABLES

A. Comply with requirements in Section 260400 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
   1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
   2. Outlet boxes for optical-fiber cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
   3. Flexible metal conduit shall not be used.

B. Comply with TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
   2. Secure conduits to backboard if entering the room from overhead.
   3. Extend conduits 3 inches above finished floor.
   4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. General Requirements for Cabling:
   1. Comply with TIA-568-C Series of standards and BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems".
   2. Cables may not be spliced.
   3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
   5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   6. Support: Do not allow cables to lay on removable ceiling tiles.
   7. Secure: Fasten securely in place with hardware specifically designed and installed to not damage cables.

F. Installation of Control-Circuit Conductors:
   1. Install wiring in raceways. Comply with requirements specified in Section 260400 "Raceways and Boxes for Electrical Systems."

G. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

H. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.

I. Minimum Control-Circuit Conductor Sizes:
1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

J. Identification: Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.3 INSTALLATION OF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

A. Conductor Material Applications:
1. Feeders: Copper for feeders smaller than No. 250 MCM; copper or aluminum for feeders No. 250 MCM and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Adjust raceway sizes accordingly where use of aluminum material is allowed.
2. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
3. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

B. Conductor Insulation and Multiconductor Cable Applications and Wiring Methods:
1. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
2. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
4. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
5. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
6. Branch Circuits Concealed in Millwork and Wall Partitions: Metal-clad cable, Type MC.
7. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

C. Installation of Conductors and Cables:
1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

2. Complete raceway installation between conductor and cable termination points according to Section 260400 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
5. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
6. Support cables according to Section 260400 "Hangers and Supports for Electrical Systems."

D. Connections:
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
2. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

E. Identification: Identify and color-code conductors and cables according to NFPA 70. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

G. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260400 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

H. Other Requirements:
1. Conductors No. 4 and larger, provide insulating bushings or insulating sleeves.
2. Provide barriers in boxes where different voltages and conductor insulation exist.
3. Install control wiring for equipment or as required by other Division Trade Work.
4. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with a minimum of two half-lapped layers of Scotch Brand No. 33 vinyl-plastic electrical tape.
5. Provide expansion fittings in conduits which are non-continuous and exposed to the weather.

I. Wire Sizes:
1. Increase wire sizes and raceway to next largest AWG size for: (Size shown of 60% load, increase as required for larger loading)
   a. 120 volt circuits exceeding 150 feet in circuit length.
   b. 208 volt circuits exceeding 250 feet in circuit length.
2. Wire sizes shall be increased for the above conditions whether indicated on the Drawings.

J. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.
   1. Make splices electrically and mechanically secure with pressure-type ILSCO Snapblock connectors, or LSI lugs to make splices electrically and mechanically secure. Soldering is not permitted for grounding equipment.
      a. For wires size 6 AWG and smaller, provide "Scotch-lock" connectors.
   2. For wires size 4 AWG and larger, provide Burndy "Versitaps" and heavy-duty connectors, or T&B "lock-tite" connectors.

3.4 INSTALLATION OF GROUNDING SYSTEMS

A. Coordinate existing conditions and wiring configurations to assure proper grounding systems are installed per NEC Art. 250. Where existing system grounding means are not known or clearly identifiable, contact Owner to provide as-built documents prior to start of Work.

B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

C. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connections to Structural Steel: Welded connectors.

F. Grounding at The Service: Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

G. Comply with IEEE C2 grounding requirements.

H. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2

inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

I. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

J. Equipment Grounding: Install insulated equipment grounding conductors with all feeders and branch circuits.

K. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

L. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

M. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

N. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except were routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

O. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

P. Perform tests and inspections as listed in “Testing and Inspections”.

Q. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

R. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

3.5 HANGERS AND SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 utilizing listed beam clamps and supports. Tie-wires shall not be an acceptable method of securing raceways.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

G. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

H. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

I. Concrete Bases:
1. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2. Use 3000-psi , 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements as specified by equipment manufacturer.
3. Anchor equipment to concrete base:
   a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Install anchor bolts to elevations required for proper attachment to supported equipment.
   c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.6 RACEWAYS AND BOXES INSTALLATION

A. Selection of Raceways: Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:
1. Exposed and Subject to Physical Damage: RMC.
2. Exposed and Not Subject to Physical Damage: IMC.
3. Concealed Aboveground: EMT.
4. Direct Buried: PVC-40.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Hazardous Classified Locations: RMC.
2. Exposed and Subject to Physical Damage: IMC.
3. Exposed and Not Subject to Physical Damage: EMT.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: IMC.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.

D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
   1. RMC and IMC: Provide threaded type fittings unless otherwise indicated.

E. Installation of Raceways:
   1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
   2. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for hangers and supports.
   3. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
   4. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4” and insulated throat metal bushings on 1-1/2” and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
   5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   6. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
   7. Support conduit within 12” of enclosures to which attached.
   8. MC Cable or FMC is allowed in limited uses: Lighting whips, interior partition walls, and millwork. MC Cable is NOT allowed for homerun branch circuits.
   9. Adjust raceway sizes required for derating and ambient temperatures.
   10. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging to prevent unnecessary cutting.
   11. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
       a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
       b. Where an underground service raceway enters a building or structure.
       c. Conduit extending from interior to exterior of building.
   12. Do not install conduits within 2” of the bottom side of a metal deck roof.
   13. Keep raceways at least 6” away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
   14. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength.
   15. Do not install aluminum raceways or fittings in contact with concrete or earth.

F. Underground conduit installations where open trenching occurs and accessible to public, shall require barriers and warning tape per OSHA guidelines.

G. Where conduit or wiring is exposed, run parallel to, or at right angles with, lines of the building.
   1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
   2. Make bends free from dents and flattening.
   3. Where outlets and devices are installed exposed on masonry walls, contractor shall route conduit up to highest point on wall to junction box serving the device vertically.

H. Where conduits pierce the roof, provide 24-gauge galvanized iron roof jacks and flashing collar brazed onto the conduits and covering the top of the roof jacks. Any brazing shall occur prior to installation of conductors.

I. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Architect.

J. Installation of Boxes and Enclosures:
   1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
   2. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
   3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
   4. Locate boxes so that cover or plate will not span different building finishes.
   5. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
   6. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
   7. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
   8. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

K. INSTALLATION OF UNDERGROUND RACEWAYS

L. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit 36-inch below grade and 24-inch below finished slab-on-grade. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
   2. Install backfill as specified in Section 312000 "Earth Moving."
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final

conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles, equipment pads and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
   c. For PVC stub-ups at equipment mounted on concrete bases with formed raceway opening to enter cabinets, enclosures and boxes. Install PVC End Bell on service conduits for conductors No. 4 AWG and larger prior to pulling conductors.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape: Provide at all utility and onsite generation for service entrances and comply with requirements listed by the Owner and local utility company.

M. INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
4. Install handholes with bottom below frost line, 16-inches below grade.
5. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
6. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.7 SLEEVE-SEAL SYTEM INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and as specified by roofing manufacturer.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

H. Sleeve-Seal-System Installation
   1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
   2. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

I. Sleeve-Seal-Fitting Installation
   1. Install sleeve-seal fittings in new walls and slabs as they are constructed.

2. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
3. Secure nailing flanges to concrete forms.
4. Using grout, seal the space around outside of sleeve-seal fittings.

3.8 INSTALLATION OF WIRING DEVICES

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.

3.9 INSTALLATION OF FUSES

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install labels complying with requirements for identification specified in "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

3.10 INSTALLATION OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS
1. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
   a. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
f. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than ten days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner or Construction Manager's written permission.
4. Comply with NFPA 70E.

C. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

D. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

G. IDENTIFICATION
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

H. Test and Inspections: Section 260400 "Testing and Inspections."
1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

I. Prepare test and inspection reports.
1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.11 INSTALLATION OF LIGHTING

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
   1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   2. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260400 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260400 "Identification for Electrical Systems."

L. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
   3. Photometric Requirements:

a. The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard TM-21 test report, which ever one results in a higher level of lumen depreciation.
b. The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern.
c. The measurements shall be calibrated to standard photopic calibrations.
d. Luminaire shall be tested per IESNA LM 79-08.

M. Luminaire will be considered defective if it does not pass operation tests and inspections.

N. Prepare test and inspection reports.

3.12 INSTALLATION OF POWER EQUIPMENT

A. FLOOR-MOUNTED EQUIPMENT CONCRETE PAD: Install switchboards, transformers and enclosed controllers on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
1. Install conduits entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after equipment is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from enclosures and components.

C. Provide power and control wiring for HVAC, switchboards, panelboards, motor starters and safety switches as shown on the Drawings.

D. Connections to miscellaneous building equipment:
1. Wire to, and connect to, all items of building equipment not specifically described but to which line-voltage electrical power is required.
2. Coordinate as necessary with other trades and suppliers to verify types, numbers and locations of equipment.
3. Make final connections to all kitchen equipment per manufacturer's instructions.
4. Mark each pull-box/junction box with a permanent ink marker the panel designation and circuit number contained.

E. Mounting Heights:
1. Install light switch at 48 inches to center of device above finished floor. Unless otherwise noted.

2. Install convenience receptacle at 18 inches to center of device above finished floor. Unless otherwise noted.
3. Install convenience receptacle at 4 inches to center of device, above back splash of counter top. Unless otherwise noted.
4. Install telephone jack rough in at 18 inches to center of device above finished floor. Unless otherwise noted.
5. Install telephone jack for side-reach wall telephone, to position top of telephone at 54 inches to center of device, above finished floor. Unless otherwise noted.

3.13 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, of the same type and manufacture, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

3.14 MISCELLANEOUS ITEMS

A. The Contractor shall provide all miscellaneous items that would normally be required for proper installation of all electrical systems specified herein.

B. Completed wiring systems shall be free from short circuits. After completion, this Division 26 shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

C. Complete temperature control wiring rough-in is the responsibility of this Division 26. Coordinate with Division 23 to provide all locations for rough-in box and conduit requirements. Temperature control wiring shall be installed in conduit as specified by Division 23. Final terminations shall be by Division 23 unless system is 110 volts or greater.

D. Provide all disconnects and safety switches for mechanical and plumbing equipment. Where safety switches serve equipment with multiple motors, switches shall be fused according to the nameplate of the equipment, or the breaker serving the equipment shall be "HACR" type.

3.15 CUTTING AND PATCHING

A. The Electrical Contractor shall be responsible for cutting all floors, walls, partitions, ceilings or other construction required for proper installation of his Work. No cutting shall be done without prior approval of the Architect and all cutting shall be performed as directed by the Architect. Compacting of soil shall be provided in accordance to Division 2 Work. Concrete and Asphalt Work shall be provided in accordance to Division 2 Work.

B. The Electrical Contractor shall provide and install fire-safing material in penetrations through fire rated walls, floors, and ceilings in accordance with local codes.

3.16 CLEANING AND PLACING IN SERVICE

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

3.17 ADJUSTMENT AND INSTRUCTION

A. Energize all systems, equipment, and fixtures and check for proper operation. Check electrical feeders for proper phasing and balance loads between phases.

B. Position adjustable light fixtures to meet approval of Architect.

3.18 TESTING AND INSPECTION:

A. Provide personnel and equipment, make required tests, and secure approvals from the Owner and governmental agencies having jurisdiction.

B. Make written notice to the Owner adequately in advance of each of the following stages of construction:
   1. Underground electrical system installation is complete, but not covered.
   2. Rough-in installation of electrical systems are complete, but not covered.
   3. At final completion of the Work of this Section 260400.

C. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

D. Provide personnel and equipment to perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Acceptance Testing:
      a. Test insulation resistance for each distribution bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within

the enclosure and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.

b. Test continuity of each circuit. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Values shall not deviate more than 50 percent of lowest value tested.

c. Test ground-fault protection for service equipment per NFPA 70.

d. Use suitable test instrument to measure resistance to ground system. Test in accordance with test instrument manufacturer's specified fall-of potential method.

2. Tests and Inspections:

a. Perform each visual, accessible bolted electrical connection, mechanical inspection and electrical test for component type stated in NETA Acceptance Testing Specification including Tables. Certify compliance with test parameters.

b. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

c. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

d. Prior to energizing motors, verify voltages are within plus or minus 10 percent of nameplate rated voltages at motor.

e. Test each connected motor for proper phase rotation.

E. In the Owner’s Presence:

1. Test all parts of the electrical system and prove that all such items provided under this Section function electrically in the required manner.

2. Measure voltages between phases and between phase wires and neutrals, and report these voltages to the Owner.

3. Immediately submit to the Owner a report of maximum and minimum voltages, and a copy of the recording volt-meter chart.

F. Adjust and set all time clocks in accordance with Owner's instructions.

G. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

3.19 PROJECT COMPLETION:

A. Upon completion of the Work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the Manufacturer of the item being cleaned.

B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under Article 1.05 of this Section of these Specifications.

END OF SECTION 260400

SECTION 311000
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
1. Protecting existing trees, vegetation to remain.
2. Removing existing trees, vegetation.
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.

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
2. Division 1 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
3. Division 1 Section "Execution" for verifying utility locations and for recording field measurements.
4. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.03 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 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil 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.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.07 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. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 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.

3.02 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. Refer to Stormwater Pollution Prevention Plan.

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.

3.03 TREE PROTECTION

A. Do not excavate within tree protection zones, unless otherwise indicated.

B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.04 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.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.

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.

3.05 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. Remove rootballs. Remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

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.

3.06 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 nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

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 respreading deeper topsoil.

3.07 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.

3.08 DISPOSAL

A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for areas outside the building perimeter.
   2. Excavating and backfilling for buildings and structures.
   3. Subbase and base course for paving.
   4. Subsurface drainage backfill for walls and trenches.
   5. Excavating and backfilling for utility trenches.

B. Related Sections include the following:
   1. Division 01 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
   2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
   3. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
   4. 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.

1.03 UNIT PRICES

A. Unit prices for earthwork are included in Division 01 Section "Unit Prices." Unit price shall include cost for removal of soft materials and replacement of imported structural fill per cubic yard plus a unit price for rock removal per cubic yard.

1.04 DEFINITIONS

D. 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.

E. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

F. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

G. Borrow Soil: Soil imported from off-site for use as fill or backfill.

H. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

I. 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. 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.

J. Fill: Soil materials used to raise existing grades.

K. Initial Backfill: Fill free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit and as defined by utility trench detail on the plans.

L. 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, or ripping, or blasting, when permitted:
1. 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. Bulk 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.

M. 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.

N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.

O. Utilities: Underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

A. Product Data: For the following:
1. Each type of plastic warning tape.
2. Geotextile.
3. 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:
4. Classification according to ASTM D 2487 of each soil material proposed for fill and backfill.
5. Laboratory compaction curve according to ASTM D 698 for each soil material proposed for fill and backfill.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.06 QUALITY ASSURANCE

Q. 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.

R. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient on site materials do not match the Geotech report for engineered fill.

B. Base Course: Naturally graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; conforming to ODOT Type “A” aggregate base.

C. Engineered Fill:

1. Structural fill within the proposed building and pavement areas shall have the following properties and as specified in the geotechnical report:
    a. Material having a Plasticity Index (PI) OF 8 TO 18
    b. Material having a Liquid Limit (LL) of less than 40
    c. Maximum dry density in excess of 100 pounds per cubic foot
    d. Maximum particle size of 3 inches
    e. At least 15 percent of the material passing the No. 200 sieve, based on dry weight
    f. Shall be free of any organics
    g. Prior to any filling operations, samples shall be tested by and approved by the owner’s on-site geotechnical engineer.
2. Portions of the onsite lower plasticity clay soils may be suitable for use as structural fill within the proposed building and pavement areas; however, the contractor shall delineate the area with lower plasticity lean clay soils and collect a bulk sample prior to start of placement for moisture-density relationship and soil classification testing to evaluate the suitability for use as fill within proposed building and pavement areas.
3. Refer to geotechnical report for other uses of onsite materials as fill.

D. 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. Or as defined by the utility trench details.

E. 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.

F. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

2.02 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. 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:

7. Survivability: Class 2; AASHTO M 288.
8. Grab Tensile Strength: 247 lbf; ASTM D 4632.
9. Sewn Seam Strength: 222 lbf; ASTM D 4632.
10. Tear Strength: 90 lbf; ASTM D 4533.
11. Puncture Strength: 90 lbf; ASTM D 4833.
12. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
13. Permittivity: 0.02 per second, minimum; ASTM D 4491.
14. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

H. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type I, II or III.
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.

I. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

A. 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

3.01 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.

3.02 DEWATERING

E. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

F. 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 by providing adjacent dewatering trenches as required.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
3. It is anticipated that the groundwater will be perched within existing fill and/or underlying lower plasticity residual lean clay soils. Temporary perimeter drainage ditches, sumps, and pumps will be needed for removal of the perched water from open excavations and for the removal of additional surface rain water.

3.03 EXPLOSIVES

A. Explosives: No explosives are allowed.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsuitable soil materials and rock, replace with approved engineered fill materials.
2. Remove rock to lines and grades 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.

3. Care should be exercised during excavation/undercut of the soils adjacent to the existing building to avoid possible influence on the existing structure. The bearing materials of the foundation supporting the adjacent building should be protected during excavation.

3.05 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: undercut to a level of at least 18 inches below the design bearing elevation. Where fat clays (CH) soils are encountered, remove these soils within 18 inches of the bottom of the footing. After completion of undercutting, the footing elevations are to be brought back up to design elevation using approved and properly compacted lower plasticity engineered fill, low strength lean concrete or quick set flowable fill. Overexcavation shall extend 8 inches beyond the edges of the footing for each foot of undercut depth
2. 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. Overexcavate soils under the proposed building and other structures to a level of at least 48 inches below finished floor elevation and replace with approved lower plasticity structural fill. Overexcavation shall extend at least 5 feet beyond the building limits except where the planned buildings abut existing buildings or structures.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 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.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.08 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Architect or Engineer determines unsatisfactory soil is present based on the geotechnical engineer's recommendations, continue excavation and replace with compacted backfill or fill material as directed. Loose and disturbed materials, shall be removed from the subgrade before placing the geogrid. The subgrade shall be free of standing water when the geogrid is placed. Soil subgrades that become unstable due to inadequate construction dewatering or excessive subgrade disturbance shall be corrected by the contractor at no additional cost to the owner.

C. Soft clay soils within the building and pavement areas shall be removed full-depth and replaced with properly compacted and approved lower plasticity engineered fill.

D. Undercut any exposed clayey chert gravel (GC) exposed within the proposed building areas to a depth of at least 18 inches and replace with approved, lower plasticity engineered fill.

E. Building Areas - After stripping and completing any cuts, removal of soft clay soils. the exposed clay soils shall be scarified to a minimum depth of 9 inches, moisture conditioned to within a range of 1 percent below to 3 percent above the optimum moisture content and recompacted to at least 95% of the materials maximum dry density (ASTM D 698)

F. Pavement Areas - After stripping and completing any cuts, the exposed clay soils shall be scarified to a minimum depth of 8 inches, moisture conditioned to within a range of 2 percent below to 2 percent above the optimum moisture content and recompacted to at least 95% of the material's maximum dry density (ASTM D 698)

G. Following moisture conditioning and recompaction the exposed subgrade shall be proofrolled. Proof-roll subgrade under the observation of the geotechnical engineer, with a loaded, tandem-axle dump truck weighing at least 25 tons, to locate any zones that are soft or unstable. The proofrolling should involve overlapping passes in mutually perpendicular directions. Where rutting or pumping is observed during proof-rolling, the unstable soils shall be over-excavated and replaced with low volume change soils. The project geotechnical engineer or a qualified representative shall observe the proofrolling operations. All unstable and/or soft materials identified during the subgrade evaluation need to be removed prior to the placement of fill or construction of building and pavements.

H. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.09 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 Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated on-site suitable 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, sub-drainage, damp-proofing, 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. Place and compact initial backfill of , 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.

D. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

E. Backfill voids while installing and removing shoring and bracing.

F. Place and compact final backfill to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

H. Construct clay “trench plug” that extends at least 5 feet out from the face of the building exterior. The plug material shall consist of clay compacted at a water content at or above the soils optimum water content. The clay fill shall be placed to completely surround the utility line and be compacted to at least 95% standard proctor density.

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 engineered fill or on-site material.
   2. Under walks and pavements, use engineered fill or on-site 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.

D. Existing slopes steeper than 5 horizontal to 1 vertical (5:1) and located in fill areas shall be benched prior to fill placement. Benches shall be cut as the fill placement progresses and shall have a maximum bench height of 2 to 3 feet.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within range of 2 percent above to 2 percent below the material's optimum moisture content, determined in accordance with ASTM D-698, (standard Proctor procedure).

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. Both density and moisture requirements shall be met.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers between 8 and 12 inches in 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 8 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent and 95 percent for pavement areas.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 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 85 percent.
4. For utility trenches in unpaved areas, compact each layer of initial and final backfill soil material at 85 percent. In paved areas, compact utility trench backfill at 95 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: Plus or minus 1 inch.
2. Walks and Pavements: 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.

3.18 BASE COURSES

A. Place base course on subgrade free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:
   1. Where indicated, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Shape base course to required crown elevations and cross-slope grades.
   3. Place base course in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact 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.

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. Place drainage course in compacted thickness shown on plans in a single layer.
   2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry relative density according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

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. Contact Engineer for subgrade proofrolling.

D. 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.

E. Perform Atterberg limits tests on fly ash and cement kiln dust treated fill/backfill materials placed in the building area for the low volume change fill layer at frequency of at least 1 test per 5,000 SF of area with at least 2 test per lift. Intent or Atterberg limits testing is to determine if the soil has been effectively treated.

F. 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 150 feet or less of trench length, but no fewer than 2 tests.

G. 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.

H. Density and moisture test shall be performed on each lift prior to placement of subsequent lifts.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion prior to placement of subsequent base course, paving, or foundations above. 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.

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. Remove waste material, including unsuitable soil, trash, and debris, and legally dispose of it off Owner's property.

B. Transport surplus engineered fill to designated storage areas on Owner's property.

END OF SECTION

SECTION 312500

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Installation of temporary and permanent erosion and sedimentation control systems.
2. Installation of temporary and permanent slope protection systems.

Related Sections

1. Section 31 10 00 – Site Clearing
2. Section 31 20 00 – Earth Moving

1.02 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties; any identified endangered or threatened species or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization.

1.03 REFERENCES

A. Oklahoma Department of Transportation, Standard Specifications for Highway Construction, 2009 (including amendments, supplements and special provisions).

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sediment control devices as specified on the Construction Drawings. Specified items on the Construction Drawings shall comply with Section 221 of the ODOT Standard Specifications.

B. Rip-Rap as specified on the plans and in Section 31 37 00.

C. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.01 PREPARATION

A. Review the drawings and Storm Water Pollution Prevention Plan.

B. Revise SWPPP as necessary to address potential pollution from site.

C. Conduct storm water preconstruction meeting with Site Contractor, all ground-disturbing subcontractors, site engineer of record or someone from their office familiar with the site and SWPPP.

3.02 EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the drawings and Storm Water Pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. Deficiencies or changes on the drawings or Storm Water Pollution Prevention Plan shall be corrected or implemented as site conditions change. Changes during construction shall be

noted in the Storm Water Pollution Prevention Plan and posted on the drawings (Erosion Control Plans).

C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

D. Maintain temporary erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours if required at no additional cost to the Owner.

E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

F. Unless required within a shorter timeframe by the applicable General Permit for Storm Water Discharges Associated with Construction Activity, disturbed areas that will not be graded or actively worked for a period of 14 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Curbs and gutters.
   2. Walkways.
   3. Ramps and steps.
   4. Drives and roadways

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
   2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
   3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.03 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.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. 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.

C. Qualification Data: For manufacturer.

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. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

F. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. 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.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 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.

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.

2.02 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

H. Plain Steel Wire: ASTM A 82.

I. Deformed-Steel Wire: ASTM A 496.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed.

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

L. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.

M. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

N. 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

O. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

P. Zinc Repair Material: ASTM A 780.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use one of cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement

B. Normal-Weight Aggregates: ASTM C 33, Class coarse aggregate, uniformly graded. Conform to ODOT specifications for highway construction. Provide aggregates from a single source.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures as allowed by ODOT specifications for highway construction.

F. Calcium chloride shall not be permitted in concrete mixtures.

2.04 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.
   1. Products: Conform to ODOT.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
   1. Products: Conform to ODOT.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
   1. Products: Conform to ODOT.

2.05 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
   1. Color: As indicated by manufacturer's designation Match Architect's sample As selected by Architect from manufacturer's full range.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
   1. Types I and II, non-load bearing IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
   1. Products: Conform to ODOT.

2.06 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952E, Type II, with drying time of less than 45 minutes.
   1. Color: As indicated.

2.07 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 to conform to ODOT specifications for highway construction for properties.
   1. Compressive Strength (28 Days): 4,000 psi Maximum Water-Cementitious Materials
   2. Ratio at Point of Placement: 0.45.
   3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

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: 5 to 7 percent

D. Chemical Admixtures: Conform to ODOT specifications for highway construction.
   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.

E. Cementitious Materials: Conform to the ODOT specifications for highway construction Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
   1. Fly Ash or Pozzolan: 25 percent.
   2. Ground Granulated Blast-Furnace Slag: 50 percent.
   3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.08 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.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete mixes larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase 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 50 tons.
   3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/4 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by Figure 2.1.5 of ACI 305. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, monomolecular film evaporation retarders, fog spray, covering with polyethylene sheeting, or wet cover.

3.03 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.

3.04 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.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 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.

2. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
3. Provide tie bars at sides of pavement strips where indicated.
4. 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.

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 of 50 feet, unless otherwise 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:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade (within 12 hours of concrete pour), or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated and at construction joints. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 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 subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase 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 fresh concrete after testing.

F. 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.

G. 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.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. 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.

I. Screed pavement surfaces with a straightedge and strike off.

J. 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.

K. 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.

L. 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 subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

M. 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.

N. 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.

O. 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.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Initial floating operation is included in "Concrete Placement" Article.

C. 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. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. 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. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 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.

3.09 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, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. 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 21 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.

1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

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

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
   2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

C. Qualification Data: For Installer.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 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. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than four 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 analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of 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.

1.05 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.

1.06 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 joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 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.

2.03 COLD-APPLIED JOINT SEALANTS

A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
1. Products:

a. Crafco Inc.; Road Saver Silicone SL.
b. Dow Corning Corporation; 890-SL.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; 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.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 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

3.01 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.

3.02 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.

3.03 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. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 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.

3.05 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

SECTION 329223
SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Maintenance.

1.02 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.03 REFERENCE STANDARDS

A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding 2006.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Certificate: Certify grass species and location of sod source.

1.05 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Oklahoma.

B. Installer Qualifications: Company approved by the sod producer.

1.06 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod in rolls. Protect exposed roots from dehydration.

B. Protect exposed roots from dehydration.

C. Do not deliver more sod than can be laid within 24 hours.

1.08 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sod: TPI, Certified Turfgrass Sod quality; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft (100 sq m). Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

1. Bermuda Grass Type 'Astro'.

B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

C. Fertilizer: Recommended for specified grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.02 ACCESSORIES

A. Herbicide: Pre and Post Emergent Herbicide effective for controlling the germination or growth of weeds.

2.03 SOURCE QUALITY CONTROL

A. Provide analysis of topsoil fill under provisions of Section 014000.

B. Submit topsoil testing analysis for review:
   1. Analyze to ascertain percentage of nitrogen, phosphorus, potash soluble salt content, organic matter content, and pH value.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

A. Scarify subsoil to a depth of 6-inches.

B. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels profile and contours. Make change in grade gradual. Blend slopes into level areas.

C. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

3.03 PLACING TOPSOIL

A. Spread approved topsoil to a minimum compacted depth of six inches over area to be sodded. Prepare until smooth.
   1. Existing topsoil excavated and stockpiled on-site may be utilized.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material while spreading.

D. Grade to eliminate rough, low, or soft areas, and to ensure positive drainage away from structures.

E. Finish ground level firm and sufficient to prevent sinkage pockets when irrigation is applied.

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions at a rate of 3 lb./100 square feet.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.05 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Remove and dispose of plastic net backing.

C. Lay sod immediately after delivery to site to prevent deterioration. Sod pallet time shall not exceed 24 hours.

D. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.

E. Where new sod adjoins existing grass areas, align top surfaces.

F. Where sod is placed adjacent to hard surfaces, such as curbs, pavements, etc., place top elevation of sod 1 inch (25 mm) below top of hard surface.

G. Water sodded areas immediately after installation. Saturate sod to 3 inches (76 mm) of soil which is approximately 1-inch of water per day for the first 2-3 weeks.

H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.06 MAINTENANCE

A. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

B. Contractor shall water (irrigated and non-irrigated) sodded areas as required until grass is well established and exhibits a vigorous growing condition.

C. Mowing:
   1. Astro Bermuda:
      a. Mow grass at regular intervals to maintain at a maximum height of 2-inches. Do not cut more than 1/3 of grass blade at any one mowing.
      b. Mow every 5-7 days during the active growing season.

D. Neatly trim edges and hand clip where necessary.

E. Roll surface to remove irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions for the specified turfgrass type. Remedy damage resulting from improper use of herbicides.

G. Immediately replace sod to areas that show deterioration or bare spots.

H. Watering Post Establishment:
   1. Apply 1-inch of water in a single application about once per week during hot and dry conditions. To promote a deep, durable root system, deep soaking water applications are preferred over short and frequent shallow water applications.

END OF SECTION 329223

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SECTION 329300
PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Planting soil: Landscape Bed Planting Soil, Topsoil.

C. Soil amendment materials.

D. New trees, plants, and ground cover.

E. Mulch.

F. Decorative aggregate.

G. Accessories.

H. Maintenance.

I. Tree pruning.

1.02 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.03 REFERENCE STANDARDS

A. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock 2014.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning) 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Submit list of plant life sources.

C. Plant Materials: Include quantities, sizes, and quality of plant materials.

D. Submit product data/ cutsheets for planting soil, mulch, fertilizer, and accessories.

1.05 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with five years documented experience.

B. Installer Qualifications: Company specializing in installing and planting the plants with five years documented experience.

C. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, 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.

D. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

E. Tree Pruning: Conform to ANSI A300 Part 1.

F. Maintenance Services: Performed by installer.

1.06 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.08 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C).

B. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

C. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

D. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.
   2. Do not proceed with interruption of services or utilities without Owner's written permission.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year warranty.

C. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

D. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.10 MAINTENANCE

A. Reference Part 3 of this section.

PART 2 PRODUCTS

2.01 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

B. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

C. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.02 SOIL MATERIALS

A. Landscape Bed Planting Soil: 50% Gem Dirt Garden Soil (or approved equal)/ 50% topsoil. Verify suitability of native surface topsoil to produce viable planting soil.

B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

2.03 SOIL AMENDMENT MATERIALS

A. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

B. Herbicide: Pre and Post Emergent Herbicide effective for controlling the germination or growth of weeds within planted areas.

C. Pesticide: Registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific pest and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.04 MULCH MATERIALS

A. Organic Mulching Material: Double shredded hardwood mulch (natural color), free of growth or germination inhibiting ingredients.

2.05 DECORATIVE AGGREGATE

A. Aztec 3/16"-5/16", clean, by Minick Materials or approved equal.

2.06 ACCESSORIES

A. Root Ball Stabilization Devices: Below grade stabilization systems to secure each new tree by root ball; sized per manufacturer's instructions.
   1. Approved Products:
      a. Foresight Products, LLC; Duckbill Rootball Fixing System.
      b. Approved equal.

B. Tree Protector: by Arborgard, or approved equal; grey

2.07 SOURCE QUALITY CONTROL

A. Provide analysis of topsoil; comply with requirements of Section 014000.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt, organic matter, and pH value.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil and landscape beds are ready to receive work.

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

D. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

E. Install 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.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches (75 mm) where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.03 PLACING PLANTING SOIL

A. Place planting soil during dry weather and on dry unfrozen subgrade.

B. Remove vegetable matter and foreign non-organic material from soil while spreading.

C. Grade planting soil to eliminate rough, low or soft areas, and to ensure positive drainage.

D. Install soil into pits and beds intended for plant root balls at depth per Drawings.

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.05 PLANTING

A. Excavate two-three times as wide as root ball diameter.
   1. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
   2. Maintain supervision of excavations during working hours.
   3. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
   4. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

B. Place plants as indicated for review and final orientation by Architect.

C. Relocate plants as directed for approval.

D. Set plants vertical.

E. Remove non-biodegradable root containers.

F. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth as indicated on drawings under each plant. Remove burlap, ropes, and wires, from the root ball.

G. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch (150 mm) layers. Maintain plant life in vertical position.

H. Saturate soil with water when the pit or bed is half full of planting soil and again when full.

3.06 MULCHING

A. Apply three inch (four inch at trees) minimum thickness of mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.07 DECORATIVE AGGREGATE

A. Install clean decorative aggregate to a minimum compacted thickness and area as indicated per the drawings.

3.08 INSTALLATION OF ACCESSORIES

A. Wrap tree trunks with tree protectors.

3.09 PLANT SUPPORT

A. Root Ball Stabilization: Install root ball stabilization system sized and positioned as recommended by manufacturer and according to manufacturer's written instructions.

3.10 TREE PRUNING

A. Prune trees as recommended in ANSI A300 Part 1.

B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.11 CLEAN UP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

D. Disposal: Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

3.12 MAINTENANCE

A. Maintain plant life for three months after Date of Substantial Completion.

B. Cultivate and weed plant beds and tree pits.

C. Remove dead or broken branches and treat pruned areas or other wounds.

D. Immediately remove clippings after trimming.

E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

F. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.

G. Remedy damage from use of herbicides and pesticides.

H. Replace mulch when deteriorated.

I. Repair or replace accessories when required.

END OF SECTION 329300

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SECTION 334100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Drains & pipes.
   2. Storm Inlets
   3. Precast concrete manholes.
   4. Concrete headwalls

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene-monomer rubber.

B. LLPE: Linear low-density, polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.04 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silt tight, unless otherwise indicated.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Catch Basins
   2. Pipe and fittings
   3. Manholes
   4. Stormwater Inlets
   5. ODOT concrete end sections

B. Shop Drawings: For the following:
   1. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.

C. Field quality-control test reports.

1.06 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, catch basins, and stormwater inlets according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.02 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 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.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, 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 pipe and fittings.

C. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, 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 pipe and fittings.

2.03 PVC PIPE AND FITTINGS

A. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 40 pipe, with plain ends for solvent-cemented joints with ASTM D 2466, Schedule 40, socket-type fittings.

B. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35 with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Sewer Pipe and Fittings, NPS 18 (DN 450) and Larger: ASTM F 679, T-[1] [2] wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

D. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.04 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot or groove and tongue ends.
   1. Gasketed joints with ASTM C 443, rubber gaskets, “omni-flex” or equal
   2. Class III, Wall A.

2.05 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.06 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification(s): Extra-heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.07 DRAINS

A. As specified on plans, or equivalent.

2.08 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, Grade 60, deformed steel.

2.09 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

2.10 PIPING INSTALLATION

A. 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.

2.11 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

2.12 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

2.13 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

D. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.

E. Fasten grates to channel sections if indicated.

F. Assemble channel sections with flanged or interlocking joints.

G. Embed channel sections in 4-inch (102-mm) minimum concrete around bottom and sides.

2.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches 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. Re-inspect and repeat procedure until results are satisfactory.

2.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 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 nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
      a. Shielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

3.03 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, nonpressure 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 NPS 6 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 36-inch minimum cover.
   4. Install piping below frost line.
   5. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
   6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
   7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.04 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure 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 PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
   3. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   4. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints and proper tolerances for the Omni-flex gaskets.
   5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.06 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.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.07 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.08 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill according to piping manufacturer's written instructions.

3.09 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
   1. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use warning tape over 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 24 inches 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. Re-inspect 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 soiltight 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 924.
      d. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
      e. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

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 as required.

END OF SECTION